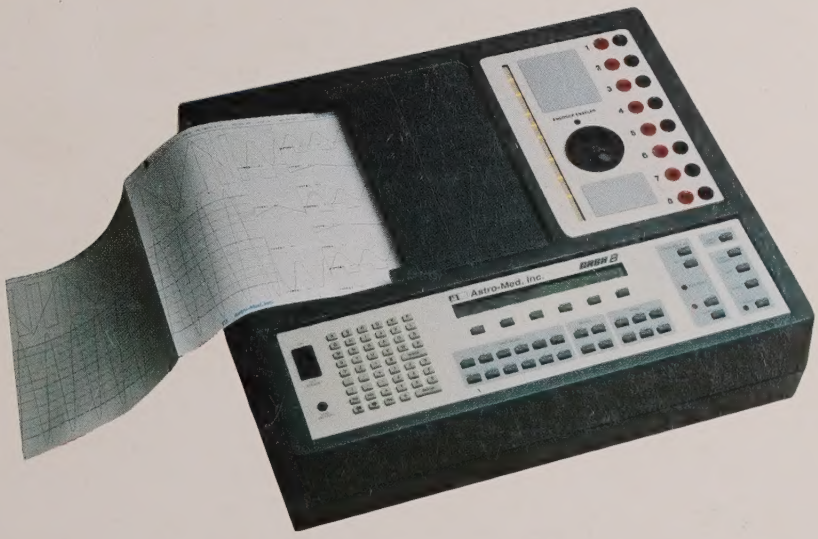
Astro-Med, Inc.



DASH 8

Host Control

Manual

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DASH 8

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Manual

MANUAL PART NUMBER: 22834-007

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Model Number:_____

Serial Number:_____

Software Version:_____
(original installation)

Upgraded Software Version:_____
(date installed: ___/___/___)

Upgraded Software Version:_____
(date installed: ___/___/___)

Upgraded Software Version:_____
(date installed: ___/___/___)

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Table of Contents

Chapter 1: Introduction

Establishing Host Control	1-2
Recorder Modes	1-3
System Setup	1-3
Operating Modes	1-4
Command Structure	1-4
Command Types	1-5
Queries	1-6

Chapter 2: Establishing Host Control

Pin Connection	2-2
Setting GPIB Communications Attributes	2-3
Remote/Local Control	2-4
GPIB Capabilities	2-5
Interface Commands	2-6
Serial Poll	2-7
Defining the Status Byte	2-8
Status Request	2-9
DASH 8 Input/Output Buffers	2-9

Table of Contents

Chapter 1: Introduction

Establishing Host Control 1-2
Recorder Modes 1-3
  System Setup 1-3
  Operating Modes 1-4
Command Structure 1-4
  Command Types 1-5
  Queries 1-6

Chapter 2: Establishing Host Control

Pin Connection 2-2
Setting GPIB Communications Attributes 2-3
Remote/Local Control 2-4
GPIB Capabilities 2-5
Interface Commands 2-6
Serial Poll 2-7
Defining the Status Byte 2-8
Status Request 2-9
DASH 8 Input/Output Buffers 2-9

CHAPTER 3: SYSTEM SETUP

Initial Preparation 3-1
Preparatory Functions 3-2
Form Feed 3-2
Paper Advance 3-2
Help Sheet 3-2
Set Help-Sheet Language 3-3

System Setup 3-4
System Default Setup 3-4
Storing Multiple Setups 3-4

System Setup Commands and Queries 3-5

Timing Setup 3-8
Set Time 3-8
Set Date 3-9
Motor Clock Source 3-9
Time Mark Interval 3-10

Chart and Grid Setup 3-11
Print Grid 3-13
Minor Divisions 3-13
Synchronize Grid 3-14
Print System Event Marker 3-15
Print System Log Channel 3-16
Edit System Log Channel 3-16
Edit On-Demand Buffer 3-17
Automatic Identification 3-18
Interchannel Annotation/Event Marker 3-19
Edit Interchannel Text Buffer 3-19
Pen Lift 3-20
User Chart Setup 3-21
Position Text Buffer 3-23
Position Event Buffer 3-23
Define User Grid 3-24
Define Signal Size 3-25
Position Channel 3-27

Analog Setup 3-28
Ground Channel 3-28
Automatic Calibration 3-28
Numeric Calibration 3-30
Auto-Range 3-31
Select Auto-Range Channels 3-32
Select Time Duration 3-32
Perform Auto-Range 3-33
Range 3-34
Zero Position 3-35
Zero Suppression 3-36
Mode 3-37
Filter 3-37
Signal Conditioner Reporting 3-38

Acquire Setup 3-39
Sample Rate 3-40
Trigger/Window Relation 3-40
Acquisition Type 3-41

Trigger Setup 3-42
Trigger Source 3-43
Trigger Logic 3-44
"And" Channel 3-44
"Or" Channel 3-45
Trigger Level/Slope 3-46
Timed Trigger 3-47

Playback Setup 3-48
X and Y Channels 3-49
Magnification 3-49
Playback Percentage 3-50

Chapter 4: Operating Modes

4-1 Real-Time Recording Modes 4-2

Analog Real-Time Recorder Mode 4-2

Analog Real-Time Recorder Commands and Queries 4-4
Start/Stop Toggle 4-4
Run and Halt 4-4
Set/Change Motor Speed 4-5
Identification 4-6
Print Interchannel Text Buffer 4-6
Print On-Demand Buffer 4-7
Background Data Capture 4-7
Exit Analog Real-Time Recorder Mode 4-9

Data Logger Mode 4-10

Data Logger Commands and Queries 4-11
Start/Stop Toggle 4-11
Run and Halt 4-12
Background Data Capture 4-13
Exit Data Logger Mode 4-14

Timed Operation 4-15

Timed Operation Commands and Queries 4-15
Set Start Time 4-16
Set Stop Time 4-16
Set Timer Speed 4-17
Set Timer Format 4-18
Start Timed Operation 4-19

Dual-Speed Operation 4-20

Dual-Speed Commands and Queries 4-20
Set Dual Speeds 4-21
Dual-Speed Switch 4-22
Dual-Speed Duration 4-22
Dual-Speed Format 4-23
Start Dual-Speed Operation 4-24

4-2 Data Capture and Playback Modes 4-25

Data Capture Mode 4-25

Data Capture Command 4-26
Exit 4-26

Data Playback Mode 4-27

Data Playback Commands and Queries 4-29
Start/Stop Toggle 4-29
Run and Halt 4-30
Identification 4-31
Print Interchannel Text Buffer 4-31
Print On-Demand Buffer 4-32
Exit Data Playback Mode 4-32

4-3 Data Transfer Mode 4-33

4-4 Line Printer Mode 4-36

Appendix A: Command Headers

Appendix B: Multiline Interface Messages

Index

List of Tables

Chapter 1

Table 1-1	DASH 8 Mode Entry Commands	1-6

Chapter 2

Table 2-1	GPIB (IEEE-488) Pin Connection Data	2-2

Chapter 3

Table 3-1	Complete System Setup Commands	3-4
Table 3-2	Default Operating Conditions	3-6
Table 3-3a	Timing Setup Commands	3-8
Table 3-3b	Timing Setup Queries	3-8
Table 3-4	Tri-level Time Marks	3-11
Table 3-5a	Chart and Grid Setup Commands	3-12
Table 3-5b	Chart and Grid Setup Queries	3-12
Table 3-6	Grid Synchronization	3-14
Table 3-7a	User Chart Setup Commands	3-22
Table 3-7b	User Chart Setup Queries	3-22
Table 3-8	Waveform/Grid Sizes	3-25
Table 3-9	Channel Position Ranges	3-27
Table 3-10a	Analog Setup Commands	3-29
Table 3-10b	Analog Setup Queries	3-29
Table 3-11	Full-Scale Input Ranges	3-34
Table 3-12a	Acquire Setup Commands	3-39
Table 3-12b	Acquire Setup Queries	3-39
Table 3-13a	Trigger Setup Commands	3-42
Table 3-13b	Trigger Setup Queries	3-43
Table 3-14a	Playback Setup Commands	3-48
Table 3-14b	Playback Setup Queries	3-48

Chapter 4

Table 4-1	DASH 8 Mode Entry Commands	4-1
Table 4-2a	Analog Real-Time Recorder Commands	4-3
Table 4-2b	Analog Real-Time Recorder Queries	4-3
Table 4-3a	Data Logger Commands	4-12
Table 4-3b	Data Logger Queries	4-12
Table 4-4a	Timed Operation Commands	4-15
Table 4-4b	Timed Operation Queries	4-15
Table 4-5a	Dual-Speed Commands	4-20
Table 4-5b	Dual-Speed Queries	4-20
Table 4-6	Data Capture Command	4-26
Table 4-7a	Data Playback Mode Commands	4-29
Table 4-7b	Data Playback Mode Queries	4-29

List of Illustrations

Chapter 1

Figure 1-1	Modes of Operation	1-3

Chapter 2

Figure 2-1	DASH 8 Recorder — Rear View	2-1

Chapter 4

Figure 4-1	96-Column Line Printer	4-38
Figure 4-2	96-Column Inverted Line Printer (180° rotation)	4-39
Figure 4-3	Page Printer	4-40

1 INTRODUCTION

Astro-Med's DASH 8 Recorder comes with a documentation package that can help you to exploit the full potential of the recorder. If you plan to operate the recorder under the control of a host computer, you would derive most benefit by becoming familiar with both manuals:

The *DASH 8 Host Control Manual* provides information on the operation of the DASH 8 Recorder under the control of a host computer. You will use this manual as your primary source of information on the recorder's operating modes and associated commands.

The *DASH 8 Operations Manual* provides information on the operation of the DASH 8 Recorder as a stand-alone instrument and contains much valuable information about the recorder and its modes of operation. Whenever additional information is desired about a mode of operation, a recorder option, any theory of operation, or recorder feature, refer to this manual.

This manual is organized to present information in the following order:

- Chapter 2 provides the information required to establish the link between the host computer and the DASH 8 Recorder.
- Chapter 3 covers system setup information, which specifies the conditions and results of the recorder's output.
- Chapter 4 explains the operating modes the commands and queries that are specific to each particular mode. In addition to these commands, all system commands are also available from within the operating modes.

Establishing Host Control

Host control of the DASH 8 Recorder can be established through the GPIB (IEEE-488) port. In addition to controlling operation of the recorder, the host computer can receive data from the recorder over the communications interface.

Requirements for establishing host control are explained in Chapter 2 of this manual.

Recorder Modes

The host computer transmits simple mneumonic-based commands to the recorder to access and exit the various operational modes. The recorder while not performing any operation is in Idle Mode and awaiting instruction.

In general, the recorder modes have a tree structure. The modes of operation can be represented as follows:

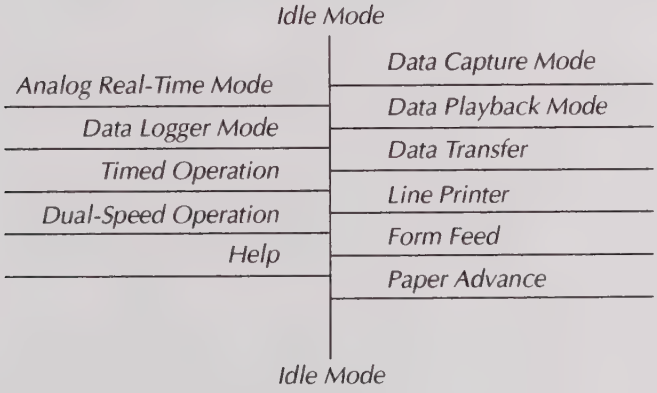


Figure 1-1: Modes of Operation

System Setup

The DASH 8 Recorder can be operated immediately after establishing control under the current or active system setup. The recorder also has a factory-set default setup available. However, before beginning to use the recorder, you will probably want to customize the output to your own requirements and preferences. You can alter any of the system parameters to create another current (active) system setup, as well as store three additional setups for immediate recall.

System setup is fully explained in Chapter 3.

Operating Modes

Host control of the DASH 8 permits use of the same modes as are available during standalone operation. In addition, there are several modes that are unique to host-control operation.

Through host control, the recorder is able to:

- Record real-time analog chart representations or digital data
- Capture and store data to be played back (printed) at a later time
- Transmit data to the host computer
- Function as a line printer

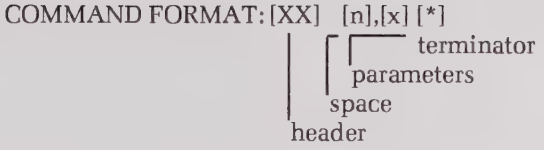
Each mode has a particular set of commands available to it, in addition to the system setup commands. (The only exception is Line Printer Mode, from which you must exit before system setup commands are accepted.)

Some modes of operation require specific options to be installed in the recorder. Wherever this is the case, it is noted at the beginning of the section describing the mode.

All operating modes and their related commands are described in Chapter 4, "Operating Modes."

Command Structure

The DASH 8 Recorder responds to a simple mneumonic-based set of commands that allows easy access to and exit from a variety of operational modes. To instruct the recorder to enter or exit a mode or to perform a function, you send it a command from the host. A command is comprised of a header and parameters and is concluded by a message terminator.



Command Header: a two-character device command for any function. The command header may be either upper or lower case characters; they are depicted as upper case throughout this manual.

Parameters: program data that completes the command string

Command terminator: typically a newline character, but depends on type of communication and terminator selected

Separators: a minimum of one space between the header and parameters, a comma between parameters

Command Types

In general, the DASH 8 has three types of commands: system setup, mode, and function commands:

- The system setup commands establish system-wide recording conditions and are valid from Idle Mode and from the operating modes (with the exception of Line Printer Mode).

- The mode commands enter the recorder into a particular mode of operation and are valid from Idle Mode and from the operating modes.

- Function commands perform functions or request information and are valid within the operating modes.

The recorder while not performing any operation is in Idle Mode and awaiting instruction.

At power up, the recorder is either in Idle Mode or a real-time mode if it was in a real-time mode at power down. You enter any of the following modes by issuing the appropriate mode command.

Table 1-1: DASH 8 Mode Entry Commands

Real-Time Recording Modes:	RT	Analog Real-Time Recorder
	DL	Data Logger
	TB	Timed Operation
	DB	Dual-Speed Operation
Data Capture and Playback Modes:	AC	Acquire (Data Capture)
	PM	Data Playback
Data Transfer Mode:	UP	Data Transfer
Additional Printing Mode:	LP	Line Printer
Additional Commands:	FF	Form Feed
	HS	Help Sheet
	PV	Paper Advance

Queries

Host control of the DASH 8 Recorder includes query capability, allowing the host computer to request current recorder settings while under host control through the IEEE-488 interface. As with the other host control commands, the query commands are simple mneumonic-based commands.

To request a setting, the host computer sends a query command to the recorder. This query consists of the normal command header followed immediately by a question mark. The response message format is similar to the command parameters used for setting the attribute.

The full query request is comprised of the normal command header followed immediately by a question mark, parameters (if any), and a concluding message terminator. A space is required after the question mark, and commas are required to separate parameters if there are more than one. To request information, send a query command in the following format.

COMMAND FORMAT: [XX?] [n] [*]

- header
- space
- parameter(s)
- terminator

Query headers are valid only in the DASH 8 recorder modes in which the equivalent command headers are valid.

2 Establishing Host Control

The DASH 8 Recorder can be linked to a host computer via the GPIB interface, located at the back of the DASH 8 Recorder. Figure 2-1 illustrates the back of the recorder.

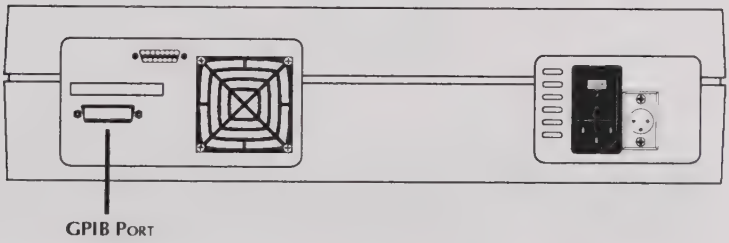


Figure 2-1: DASH 8 Recorder — Rear View

The first step in setting up host control is to ensure proper cable connection and set the transmission protocol. These parameters are set on the recorder itself through the SYSTEM menu.

Pin Connection

The GPIB D-shell connector is the IEEE communications interface between the DASH 8 Recorder and various host-computer configurations. The GPIB connection on the DASH 8 is located on the rear of the recorder, as illustrated in Figure 2-1. Pin connection data for the GPIB (IEEE-488) connector is provided in Table 2-1.

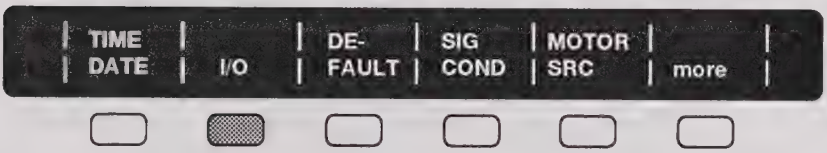
Table 2-1: GPIB (IEEE-488) Pin Connection Data

Pin #	*Description*	*Pin #*	*Description*
1	DI01	13	DI05
2	DI02	14	DI06
3	DI03	15	DI07
4	DI04	16	DI08
5	EOI	17	REN
6	DAV	18	GROUND (6)
7	NRFD	19	GROUND (7)
8	NDAC	20	GROUND (8)
9	IFC	21	GROUND (9)
10	SRQ	22	GROUND (10)
11	ATN	23	GROUND (11)
12	SHIELD	24	GROUND LOGIC

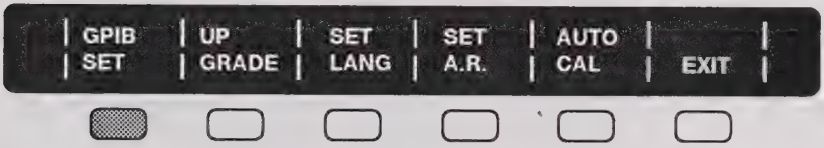
GROUND (X) = the signal ground return of the referenced contact

Setting GPIB Communications Attributes

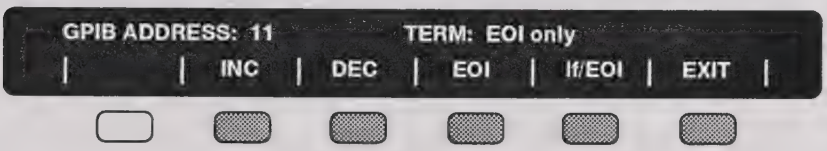
To set the attributes for GPIB communication, press the SYSTEM key on the recorder. Level 1 of the system menu displays. Press the soft key beneath "more" once or twice, until the following menu displays.



Press the soft key beneath I/O to invoke the communications menu.



Then press the soft key beneath GPIB SET to access the menu that allows you to define the communications setup for host control operation. From this menu, you specify a GPIB address and a terminator for all command sequences.



Press the soft key beneath INC to increase the GPIB address to the next higher address number. Press the soft key beneath DEC to decrease the GPIB address to the next lower address number. Valid addresses for any device are 00-30 inclusive. This address is stored in non-volatile memory and will not be affected by power loss.

Press the soft key beneath EOI (end or identify) to specify that only an EOI pulse will be recognized as a terminator. Press the soft key beneath lf/EOI to specify that a line feed <lf> control character and/or an EOI pulse will be recognized as a terminator. If EOI only is selected, it is required that EOI = 1 be sent on the last byte of the data transfer or command sequence. If lf/EOI is selected, the line feed character <lf> can be interpreted as the end of a string message. In this manual the GPIB terminator is indicated as <lf>.

Both current selections are indicated on the display. Press the soft key beneath EXIT to return the recorder to the COMMUNICATIONS SETUP display.

Remote/Local Control

The DASH 8 uses the RL1 function to control access to remote and local operation. Once remote control is gained, local control can be disabled.

After remote control via GPIB has been established, you need only to follow the command structure presented in the remainder of this manual. While in this state, the recorder displays:

To return to local control, simply press the soft key beneath "local" on the display.

The ability to return to local control from the front panel can also be disabled, as described on page 2-6. When local control is disabled, the display reads:

To return to local control while local lockout is active, you must send the GTL (Go to Local) GPIB command (or send REN false) from the host computer.

GPIB Capabilities

GPIB communication between the host computer and the DASH 8 Recorder provides the following functions:

Source handshake	(SH1)	complete capability
Acceptor handshake	(AH1)	complete capability
Talker	(T6)	basic talker with serial poll
Extended talker	(TE0)	no capability
Listener	(L4)	basic listener
Service request	(SR1)	complete capability
Remote/local	(RL1)	complete capability
Device trigger	(DT1)	complete capability
Device clear	(DC1)	complete capability
Parallel poll	(PP0)	no capability
Bus drivers	(E2)	tri-state drivers

Separator for input: EOI or <lf>/EOI
Separator for output: EOI or <lf>/EOI

Note: If "EOI only" is selected as a terminator, the uniline message "EOI = 1" must be sent on the last byte of the data transfer or command sequence. This allows for transfers without the line-feed terminator.

Interface Commands

The following commands are sent from the host to the recorder(s) for the purposes described. With the ATN (attention) line true, multiline messages are interpreted as interface messages. See Appendix B for codes.

GTL (Go to Local)	Allows local operation of the recorder
GET (Group Execute Trigger)	Causes a valid trigger, if GPIB trigger is enabled through system setup
DCL (Device Clear)	Clears the input and output buffers and places the unit at Idle Mode command level
SDC (Selected Device Clear)	Causes an addressed DASH 8 to clear input and output buffers and place the unit at Idle Mode command level
LLO (Local Lockout)	Locks out the operator from returning to local control from the front panel
SPE (Serial Poll Enable)	Notifies all devices on the GPIB that the controller has placed the GPIB in the serial poll mode
SPD (Serial Poll Disable)	Notifies all devices on the GPIB that the controller has completed the serial poll
MLA (My Listen Address)	Message/address to device(s) whose address is specified to enable listener status
MTA (My Talk Address)	Message/address to device(s) whose address is specified to enable talker status
UNL (Unlisten)	Message to device(s) to enter unlisten state
UNT (Untalk)	Message to device(s) to enter untalk state

Serial Poll

In certain applications it may be necessary for the host to know the state of the DASH 8 Recorder. This may include troubleshooting command errors or completion of an operation. By use of service requests (SRQ), the recorder informs the host of its status.

Upon receiving an SRQ, the controller in charge performs a serial poll in search of the device(s) that has requested service; the device that has been enabled and addressed responds with a status byte (STB) message.

The status byte returned by the recorder contains information as to whether that recorder requested service (rsv = 1) and, if so, the reason. A bit is set to 1 to indicate that the condition is present or to 0 to indicate that the condition is not present. Each bit of the status byte has a unique message, as shown:

Status Byte Message:	7	6	5	4	3	2	1	0
	x	rsv	BF	OC	EO	DE	CE	I

I (bit 0) **Interlock Situation**
The DASH 8 accepts data during an interlock situation. You correct the interlock situation by restocking the paper and/or closing the door.

CE (bit 1) **Command Header Error**
A command header error usually indicates an improper command header format.

DE (bit 2) **Command Data Error**
A command data error usually indicates improper program data (for example, data out of valid bounds).

EO (bit 3) **Execution Error**
An execution error occurs when a command is sent that corrupts the current operating mode or that requires an option that is not installed.

OC (bit 4) **Operation Complete**
A particular operation (for example, data acquisition, playback, calibration, auto-ranging) has finished.

BF (bit 5) **Output Buffer Full**
The output buffer is full. This bit should always be enabled if a data upload is being done or if query commands are being sent.

rsv (bit 6) **DASH 8 Requested Service**

x (bit 7) **no current use**

Defining the Status Byte

You can define what information the status byte will convey to the host computer via the Set SRQ Command. Any or all of the SRQ's may be enabled or disabled by this command as follows:

Command: [SQ] [n] [*]
Parameters: n = one byte sent in hexadecimal code with the appropriate bits set to 1 or 0 to define the status byte
bit 0 = 1 to enable interlock SRQ
bit 1 = 1 to enable command header error SRQ
bit 2 = 1 to enable command data error SRQ
bit 3 = 1 to enable execution error SRQ
bit 4 = 1 to enable operation complete SRQ
bit 5 = 1 to enable buffer full SRQ
Example: SQ 63 <lf>
defines the status byte to return recorder status information regarding all conditions: interlock situation, command header and data errors, execution error, operation completion, and buffer full.

(That is, 63 = 3F Hex = 0011 1111 Binary)

In each case a "1" enables the SRQ and a "0" disables the SRQ.

Status Request

You can request the status of the DASH 8 from the host computer via the Status Request Query:

Query:	[QS?] [*]
Parameters:	none
Valid Response:	the status byte (always two ASCII digits, decimal representation)
Example:	QS? <lf>
Sample Response:	04 <lf> indicates that a data error occurred (0000 0100).

The DASH 8 returns the status byte to the host providing the status of the DASH 8. With the Status Request Command you can monitor the status without the SRQ serial poll functions.

Note: The DASH 8 must be enabled as a talker.

DASH 8 Input/Output Buffers

The DASH 8 input buffer is a circular buffer for receiving commands and data from the host computer. The DASH 8 accepts commands as quickly as the host sends them, until a 256-byte limit is reached. The DASH 8 then holds up the host until the buffer contents are removed and resumes communication when space is again available.

The DASH 8 output buffer is also a circular buffer where responses to queries or data to be uploaded is placed to be read by host computer. The response message terminates according to the terminator selected during communications setup from the recorder's I/O Menu (that is, EOI only or <lf>/EOI).

When the output buffer becomes full, the BF bit within the status byte is set to 1 if enabled. Only a serial poll when a service request is asserted will determine whether the buffer is full. (The Status Request (QS) Query will not work, since there is not room in the buffer for the status byte.)

If the buffer becomes full, it can be cleared by reading all response messages or by issuing a Device Clear (DCL) or Selected Device Clear (SDC) interface message. These messages clear both the input and output buffers and place the DASH 8 in Idle Mode. When the buffer is empty, the DASH 8 returns the null character.

3 System Setup

Initial Preparation

Before beginning operation in any of the DASH 8's modes, you need to decide on the system parameters that will control operation. The system parameters permit you to determine how you want your chart and data printing to occur. These parameters can be changed both from Idle Mode and from within operating modes.

Before the DASH 8 is used for the first time, it is in Idle Mode with factory-set defaults when turned on. If the DASH 8 has been used previously, it automatically begins recording in the last mode in which it was operating. In either case, you can operate the recorder immediately after establishing control. However, in order to customize the output to your own requirements and preferences, you may want to establish your own system setup(s) before beginning to use the recorder.

Preparatory Functions

As you begin, you can use the following commands to correctly position the chart paper and print out basic information in condensed form.

✦ ***Form Feed*** The *Form Feed Command* will cause the recorder to perform a form feed of the chart paper to the next top-of-form index mark and return to Idle Mode to await the next mode command.

Command:	[FF] [*]
Parameters:	none
Example:	FF<lf> moves the paper to the next top-of-form mark.

✦ ***Paper Advance*** The *Paper Advance Command* will cause the recorder to advance the chart paper in increments of 1 millimeter.

Command:	[PV] [n] [*]
Parameters:	n = 1 to 100 mm
Example:	PV 12<lf> advances the paper 12 millimeters.

Note: The PV Command functions in Idle Mode or real-time recording modes. It is ignored if the DASH 8 is performing a playback; it aborts timed and dual-speed operation and the printing of Help Sheets.

✦ ***Help Sheet*** The *Help Sheet Command* causes the recorder to output a printed status or help sheet describing the desired information.

Command:	[HS] [n],[x] [*]
Parameters:	n = 1 for general help information n = 2 for keystroke information

n = 3 for DASH 8 status report
x = 0 for active status
x = 1 for status of stored setup 1
x = 2 for status of stored setup 2
x = 3 for status of stored setup 3

Note: x is required only if n = 3.

Example: HS 3,1<lf>
prints out the active status report for the DASH 8.

✦ *Set Help-Sheet Language*

The *Set Language Command* determines the language in which general help and keystroke information will print.

Command: [LA] [n] [*]
Parameters: n = 0 for English
n = 1 for Français
n = 2 for Deustch
n = 3 for Italiano
Example: LA 1 <lf>
sets the general and keystroke information sheets to print in French.

The *Set Language Query* requests the language in which general help and keystroke information will print.

Command: [LA?] [*]
Parameters: none
Valid Responses: 0 for English
1 for Français
2 for Deustch
3 for Italiano
Example: LA? <lf>
Sample Response: 1<lf>
informs you that the general and keystroke information sheets will print in French.

System Setup

To set up your system, you can use the current system setup, define or alter the current setup, use an alternate stored setup, or define or alter a stored setup. You also have the option of using a factory default setup.

Table 3-1: Complete System Setup Commands

Header	*Function*
DF	Establish default settings as system setup
ME	Memorize all current settings and store
RE	Establish stored setup as system setup

System Default Setup

✦ ***System Default***

There is a factory default setup available and a *Default Command* that can be used to establish the default settings. The Default Command always aborts the current operating mode.

Command: [DF] [*]
Parameters: none

There is no query command to access information on all of the default settings at once. However, these settings are listed in Table 3-2. (Individual queries can of course be used for individual settings.)

Storing Multiple Setups

✦ ***Memorize/ Recall***

In addition to the current (active) system setup, you can store three setups for immediate recall. In the event of a loss of power, these setups are all still available. A system setup is stored when the host issues a *Memorize Setup Command* and can be recalled by issuing a *Recall Setup Command.*

The Recall Command always aborts the current operating mode, except for the real-time modes. There are no queries associated with these commands.

Upon power loss, these setups are still available for recall. In total, there are a maximum of four system setups available to the recorder: one current (active) and three stored.

Command:	[ME] [x] [*] to memorize [RE] [x] [*] to recall
Parameters:	x = 1, 2, or 3
Example:	ME 2 <lf> memorizes all current settings and stores (saves) them as recall setup 2. RE 2 <lf> recalls and makes active all system settings stored as setup 2.

System Setup Commands and Queries

The system setup commands and queries are described in the following categories:

- Timing Setup
- Chart and Grid Setup
- Analog Setup
- Acquire Setup
- Trigger Setup
- Playback Setup
- Exit

Table 3-2: Default Operating Conditions

Real-Time Recording Defaults

Parameter	*Default Condition*
range	10.0 volts
zero position	center
zero suppression	0.0 volts
mode	peak to peak
ground/signal	signal in
filter	off
reporting	off
pen lift	down
auto-range	on
numeric	L = 200E+0 R = -200E+-
motor clock source	internal
timer interval	0.1 second
grid printing	on
printing of minor divisions	on
printing of system log	on
printing of system event marker	on
automatic identification	off
interchannel alpha-numerics/event marker	alphanumerics
recording speed	25 mm/s
Data Logger recording speed	175 ms/l

Timed Operation Defaults

Parameter	*Default Condition*
start date	01/01/91
start time	00:00:00
stop date	01/01/91
stop time	00:00:00

Dual-Speed Operation Defaults

Parameter	*Default Condition*
grid	8-channel
speed 1	25 mm/s
speed 1 duration	00:00:05
speed 2	50 mm/s
speed 2 duration	00:00:05

Data Capture/Playback Defaults

Parameter	*Default Condition*
sample rate	250 kHz
trigger/window relationship	50%
storage method	normal
playback format	8-grid
magnification	times 1
playback percentage	0% - 100%
X/Y channels	1 and 2

Trigger Setting Defaults

Parameter	*Default Condition*
trigger source	manual
"and" relationships	group A = channel 1 group B = channel 2 group C = channel 3 group D = channel 4 group E = channel 5 group F = channel 6 group G = channel 7 group H = channel 8
trigger level (high)	75%
trigger level (low)	25%

User-Chart Setting Defaults

Parameter	*Default Conditions*			
	ch 1	**ch 2**	**ch 3**	**ch 4**
signal size	x 1/4	x 1/14	x 1/14	x 1/14
signal position	152 mm	119 mm	102 mm	85 mm
grid printing	on	on	on	on
minor divisions	on	on	on	on
text position	127 mm	110 mm	93 mm	76 mm
event position	202 mm	199 mm	196 mm	193 mm

Parameter	*Default Conditions*			
	ch 5	**ch 6**	**ch 7**	**ch 8**
signal size	x 1/14	x 1/14	x 1/14	x 1/14
signal position	68 mm	51 mm	34 mm	17 mm
grid printing	on	on	on	on
minor divisions	on	on	on	on
text position	59 mm	42 mm	25 mm	8 mm
event position	190 mm	187 mm	184 mm	181 mm

Timing Setup

The ***Timing Setup Commands*** allow you to set system time, date, and timing options. Tables 3-3a and 3-3b list the Timing Setup commands and queries.

Table 3-3a: Timing Setup Commands

Header	*Function*
TI	Set time
DA	Set date
MC	Define source of motor clock
TM	Set time mark interval

Table 3-3b: Timing Setup Queries

Header	*Function*
TI?	What is the current time?
DA?	What is the current date?
MC?	Is the motor clock source internal or external?
TM?	What is the time interval between the printing of time marks?

✦ *Set Time*

The *Set Time Command* sets the time on the recorder. The time is transmitted as a string.

Command:	[TI] [x] [*]
Parameters:	x = hours, minutes, and seconds in "hh:mm:ss" format, with quotation marks
Example:	TI "10:05:35" <lf>

The associated *Time Query* requests the time from the recorder. The time is transmitted as a string.

Query:	[TI?] [*]
Parameters:	none
Valid Responses:	00:00:00 to 23:59:59
Example:	TI? <lf>
Sample Response:	"10:05:35"<lf>

✦ ***Set Date*** The *Set Date Command* sets the date on the recorder. The date is transmitted as a string.

Command:	[DA] [x] [*]
Parameters:	x = string for date in "mm/dd/yy" format with quotation marks
Example:	DA "11/01/91" <lf>

The associated *Date Query* requests the date. The response will be sent in a similar format. The date is transmitted as a string.

Query:	[DA?] [*]
Parameters:	none
Valid Responses:	01/01/00 to 12/31/99
Example:	DA? <lf>
Sample Response:	"11/01/91" <lf>

✦ ***Motor Clock*** The *Motor Clock Source Command* defines the source of the motor clock. An external clock source allows the motor speed to be controlled via an external frequency up to 800 hertz.

Command:	[MC] [x] [*]
Parameters:	x = 1 for internal clock source x = 2 for external clock source
Example:	MC 1 <lf> specifies that the recorder's internal clock will govern the motor clock.

The associated *Motor Clock Source Query* requests the source of the motor clock.

Query:	[MC?] [*]
Parameters:	none
Valid Responses:	1 for internal clock source 2 for external clock source
Example:	MC? <lf>
Sample Response:	1 <lf> informs that the recorder's internal clock governs the motor clock.

✦ TIME MARK INTERVAL

The *Time Mark Interval Command* sets the time interval for the printing of tri-level time marks at the right-edge system event marker.

Command:	[TM] [x] [*]
Parameters:	x = 0 for off x = 1 for .01 (.01/.1/1 seconds tri-level) x = 2 for .1 (.1/1/10 seconds tri-level)
Example:	TM 2 <lf> specifies the interval between printings of the shortest time mark to be .1 second.

The tri-level time mark is based upon an internal timer to print a mark at three different intervals. The height of the marks vary accordingly, with the shortest mark corresponding to the briefest interval (set by the Time Mark Interval Command), the mid-mark corresponding to 10 times the briefest, and the highest mark corresponding to the longest interval, which is 100 times the briefest.

Table 3-4 illustrates when the marks print, depending upon which time interval is selected.

Table 3-4: Tri-Level Time Marks (time in seconds)

Time Interval	Tri-Level Time Mark		
	Shortest	***Medium***	***Longest***
.01	.01	.1	1
.1	.1	1	10

The associated *Time Mark Interval Query* requests the time interval for the printing of time marks along the right edge of the chart paper.

Query:	[TM?] [*]
Parameters:	none
Valid Responses:	0 for off 1 for .01 second 2 for .1 second
Example:	TM? <lf>
Sample Response:	2<lf> indicates printing of a time mark every .1 second.

Chart and Grid Setup

The ***Chart and Grid Setup Commands*** control the way in which all printable elements (waveforms, text, event markers, grid lines) will appear on the chart. This includes whether or not elements will print, where they will print, and the size of a channel.

The commands described first control the standard recorder options; these descriptions are followed by discussions of the User Chart Commands, which allow you greater flexibility in designing the chart precisely as you wish. The User Chart setup parameters are in effect when you enter a mode by specifying user-chart format.

Tables 3-5a and 3-5b list the Chart and Grid Setup commands and queries. Tables 3-7a and 3-7b list the User Chart Setup commands and queries.

Table 3-5a: Chart and Grid Setup Commands

Header	*Function*
GR	Enable/disable printing of major chart grids
GM	Enable/disable printing of minor grid divisions
GS	Synchronize horizontal grid lines to time interval
SE	Enable/disable printing of system event marker
SL	Enable/disable printing of system log channel
ES	Edit content of system log channel
EO	Edit content of on-demand buffer
AI	Enable/disable printing of signal identification
AE	Specify whether alphanumeric data, an event marker, or nothing will print in an interchannel buffer
ED	Edit content of an interchannel text buffer
PL	Enable/disable printing for an analog channel

Table 3-5b: Chart and Grid Setup Queries

Header	*Function*
GR?	Is printing of major chart grids enabled?
GM?	Is printing of minor grid divisions enabled?
GS?	Are horizontal grid lines synchronized to time interval?
SE?	Is printing of system event marker enabled?
SL?	Is printing of system log channel enabled?
ES?	What is the content of the system log channel?
EO?	What is the content of the on-demand buffer?
AI?	Is printing of signal identification enabled?
AE?	Is an interchannel buffer set to print alphanumeric data, an event marker, or nothing?
ED?	What is the content of an interchannel text buffer?
PL?	Is printing enabled for an analog channel?

✦ ***Print Grid*** The *Print Grid Command* defines whether the major chart grid will be printed during recording.

Command:	[GR] [x] [*]
Parameters:	x = 0 for grid off
	x = 1 for grid on
Example:	GR 1 <lf>
	turns the grid on.

The associated *Print Grid Query* requests whether the major chart grid will be printed during recording.

Query:	[GR?] [*]
Parameters:	none
Valid Responses:	0 for grid off
	1 for grid on
Example:	GR? <lf>
Sample Response:	1 <lf>
	indicates the grid is on (printing).

✦ ***Minor Divisions*** The *Minor Divisions Command* defines whether minor grid divisions will be printed during recording.

Command:	[GM] [x] [*]
Parameters:	x = 0 for minor divisions off
	x = 1 for minor divisions on
Example:	GM 1 <lf>
	turns the minor divisions on.

The associated *Minor Divisions Query* requests whether minor divisions will be printed during recording.

Query:	[GM?] [*]
Parameters:	none
Valid Responses:	0 for minor divisions off
	1 for minor divisions on
Example:	GM? <lf>
Sample Response:	1 <lf>
	indicates the minor divisions are printing.

✦ **SYNCHRONIZE GRID** The *Synchronize Grid Command* allows you to synchronize the horizontal grid lines (parallel to the printhead) to one of the three levels of the right system time mark. This allows use of the chart grid lines as time marks and thereby provides true time lines that do not vary with the speed of the chart output. (If grid synchronization is not used, the grid lines print every 5 millimeters regardless of the chart speed.)

Command:	[GS] [x] [*]
Parameters:	x = 0 for off
	x = 1 for fast (in sync with shortest mark)
	x = 2 for medium (in sync with mid mark)
	x = 3 for slow (in sync with longest mark)
Example:	GS 2 <lf>
	turns on grid synchronization to medium.

You use this command simply to specify whether synchronization will occur and whether it will be fast, medium, or slow. Where on the chart the horizontal grid lines actually print is further governed by the internal time interval selected (via the Time Mark Interval Command). Fast grid synchronization corresponds to the interval selected, medium grid synchronization is ten times slower than the interval selected, and slow grid synchronization is a hundred times slower than the interval selected, as indicated in Table 3-6.

Table 3-6: Grid Synchronization (in seconds)

Time Interval	Grid Line Print Interval		
	Fast	***Medium***	***Slow***
.01	.01	.1	1
.1	.1	1	10

The associated *Synchronize Grid Query* requests whether the recorder is set for fast, medium, or slow synchronization of the grid lines, or whether synchronization is off.

Query:	[GS?] [*]
Parameters:	none
Valid Responses:	0 for off 1 for fast 2 for medium 3 for slow
Example:	GS? <lf>
Sample Response:	2<lf> indicates grid synchronization is set to medium.

✦ ***PRINT SYSTEM EVENT MARKER*** The *Print System Event Marker Command* enables or disables printing of the system event marker during recorder output. This marker is located on the left side of the chart.

Command:	[SE] [x] [*]
Parameters:	x = 0 for off x = 1 for on
Example:	SE 0 <lf> turns the system event marker off.

The *System Event Marker Query* requests whether printing of a system event marker is enabled or disabled.

Query:	[SE?] [*]
Parameters:	none
Valid Responses:	0 for printing off 1 for printing on
Example:	SE? <lf>
Sample Response:	0 indicates that the system event marker is off (not printing).

✦ ***PRINT SYSTEM LOG*** The *Print System Log Channel Command* controls whether or not the system log channel on the left edge of the chart will print.

Command:	[SL] [x] [*]
Parameters:	x = 0 turns printing off
	x = 1 turns printing on
Example:	SL 1 <lf>
	turns the system log on.

The *System Log Print Query* requests whether or not the system log channel on the left edge of the chart will print.

Query:	[SL?] [*]
Parameters:	none
Valid Responses:	0 for printing off
	1 for printing on
Example:	SL? <lf>
Sample Response:	1 <lf>
	indicates that the system log will print.

✦ ***EDIT SYSTEM LOG CHANNEL*** The *Edit System Log Channel Command* allows editing of the last thirty characters of the system log channel.

Command:	[ES] [s] [*]
Parameters:	s = ASCII text string in quotation marks
Example:	ES "System Log"<lf>
	causes "System Log" to be printed in the last 30 character spaces of the system log.

Note: If you want to insert quotation marks within the buffer, enter three sets of double quotation marks. For example, """"System Log""" will print as: "System Log"

The *System Log Content Query* requests current content of the system log channel.

Query:	[ES?] [*]
Parameters:	none
Valid Responses:	s = the text string in quotation marks (always 30 characters long with quotation marks included)
Example:	ES?<lf>
Sample Response:	"System Log " indicates that "System Log " prints in the last 30 character spaces of the system log.

✦ ***EDIT ON-DEMAND BUFFER***

The *Edit On-Demand Buffer Command* allows you to define or change the content of the buffer and to specify any of 200 locations across the chart. Row 1 corresponds to the bottom (right edge) of the grid as viewed from the front of the recorder. Rows 2 through 200 move progressively to the left across the chart. The system default for this buffer is all spaces (no printing).

Command:	[EO] [r],[s] [*]
Parameters:	r = the on-demand buffer location (row) on the chart (1 to 200) s = ASCII text string in quotation marks (up to 128 characters)
Example:	EO 58, "On-Demand Buffer"<lf> specifies that "On-Demand Buffer" should print at row 58 from the right edge of the chart when the Print On-Demand Buffer Command is sent.

Note: If you want to insert quotation marks within the buffer, enter three sets of quotation marks. For example, """"On-Demand Buffer""""" will print as: "On-Demand Buffer"

The *On-Demand Buffer Query* requests the contents of the on-demand buffer.

Query:	[EO?] [*]
Parameters:	none
Valid Responses:	x,s where: x = the on-demand buffer location on the chart (001 to 200) s = the text string (always 128 characters)
Example:	EO? <lf>
Sample Response:	058, "On-Demand Buffer " <lf> indicates that "On-Demand Buffer" will print at location 58 from the right edge of the chart.

✦ ***AUTOMATIC IDENTIFICATION***

The *Automatic Identification Command* enables or disables the repetitive (approximately once per page) printing of signal identification. In non-overlapped formats, the identification number is printed in each channel. In overlapped formats, the identification number is printed on each waveform.

Command:	[AI] [x] [*]
Parameters:	x = 0 to disable automatic identification x = 1 to enable automatic identification
Example:	AI 1 <lf> enables automatic identification.

The associated *Automatic Identification Query* requests whether the repetitive printing of signal identification is enabled or disabled.

Query:	[AI?] [*]
Parameters:	none
Valid Responses:	0 for automatic identification disabled 1 for automatic identification enabled
Example:	AI? <lf>
Sample Response:	1 <lf> indicates automatic identification is enabled.

✦ ***Interchannel Annotation*** The *Interchannel Annotation/Event Marker Command* specifies whether alphanumeric data, an event marker, or nothing will print in an interchannel buffer.

Note: Alphanumeric content is entered or edited via the Edit Interchannel Text Buffer Command.

Command:	[AE] [n],[x] [*]
Parameters:	n = channel number (1 to 8)
	x = 0 for no annotation or marker
	x = 1 for alphanumeric annotation
	x = 2 for an event marker
Example:	AE 2,2 <lf>
	places an event marker with channel 2.

The associated *Interchannel Annotation/Event Marker Query* requests whether alphanumeric data, an event marker, or nothing will print in an interchannel buffer.

Query:	[AE?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	n,0 for no annotation or marker
	n,1 for alphanumeric annotation
	n,2 for an event marker
Example:	AE? 2<lf>
Sample Response:	2,2 <lf>
	indicates an event marker with channel 2.

✦ ***Edit Interchannel Text Buffer*** The *Edit Interchannel Text Buffer Command* allows easy editing of each individual text buffer, which is an area between the channels where text can be printed with the recorded signal. (You may have up to 8 buffers.) Each interchannel buffer is 128 characters in length.

The locations of text buffers are fixed in standard setup, but are definable with user chart setup.

Command:	[ED] [n],[s] [*]
Parameters:	n = the buffer number (1 to 8)
	s = the ASCII text string in quotation marks

Example: ED 1,"Channel 1" <lf>
causes "Channel 1" to be printed beside channel 1 on the chart.

Note: If you want to insert quotation marks within the buffer, enter three sets of double quotation marks. For example, """"Channel 1"""" will print as: "Channel 1"

The *Interchannel Text Content Query* requests current content of an interchannel text buffer.

Query:	[ED?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	n,s where: n = channel number (1 to 8) s = the text string in quotation marks (always 128 characters long with quotation marks included)
Example:	ED? 1 <lf>
Sample Response:	1,"Channel 1 " indicates that "Channel 1 " prints in the interchannel text buffer for channel 1.

✦ ***PEN LIFT*** The *Pen Lift Command* enables or disables chart printing for any of the analog channels. (The name of the command is a hold-over from old recorder technology; no pen is actually lifted.)

Command:	[PL] [n],[x] [*]
Parameters:	n = channel number (1 to 8) x = 0 for down (print/record) x = 1 for lifted (no printing)
Example:	PL 1,0 <lf> enables printing of trace for channel 1.

The associated *Pen Lift Query* requests whether chart printing is enabled or disabled for any of the analog channels.

Query:	[PL?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	n,0 for down (print/record)
	n,1 for lifted (no printing)
Example:	PL? 1 <lf>
Sample Response:	1,0 <lf>
	indicates channel 1 is recording.

The ***User Chart Setup*** features expand upon the standard chart options by allowing complete flexiblity in designing custom grids. You activate the customized user chart setup when you issue a mode command to enter an operating mode. The operating modes and mode commands are described in Chapter 4.

The user chart setup commands allow you to:

- Position interchannel text in any of 200 positions across the chart
- Position event markers in any of 200 positions across the chart
- Enable or disable printing of the major grid lines on the chart
- Enable or disable printing of the minor grid divisions on the chart
- Specify the size of the selected waveform as a fraction of full scale, defining full scale as the entire chart width
- Specify the center point of the waveform

The positioning of text buffers, event markers, and waveforms is designated in millimeters. The chart is 216 mm wide, with position 1 representing the right edge of the chart and position 216 representing the left edge of the chart. Actual printing area is restricted to positions 8 through 207, providing a total of 200 different chart locations.

The size selected for a particular waveform determines the limits for positioning it; the DASH 8 does not allow you to position a waveform such that any portion of the waveform is outside of the total chart width. Table 3-9 lists these limits. Refer to the *DASH 8 Operations Manual* for an in-depth discussion of channel and waveform placement on a customized user chart.

Table 3-7a: User Chart Setup Commands

Header	*Function*
UT	Define position of an interchannel text buffer
UE	Define position of an event marker
UG	Enable/disable printing of major and minor grids
US	Define the size of a waveform
UC	Define position of a channel and waveform

Table 3-7b: User Chart Setup Queries

Header	*Function*
UT?	What is the position of an interchannel text buffer?
UE?	What is the position of an event marker?
UG?	Is printing of major and minor grids enabled?
US?	What is the size of a waveform?
UC?	What is the position of a channel and waveform?

✦ ***Position Text Buffer***

The *Position Text Buffer Command* allows you to define the position of each of the eight text buffers.

Command:	[UT] [n],[r] [*]
Parameters:	n = buffer number (1 to 8) r = millimeters from right edge (8 to 207; 0 for off)
Example:	UT 3,80 <lf> places text buffer 3 at position 80 (that is, 80 mm from the right edge).

The *Text Buffer Position Query* requests the position of a text buffer.

Query:	[UT?] [n] [*]
Parameters:	n = buffer number (1 to 8)
Valid Responses:	millimeters from right edge (8 to 207; 0 for off)
Example:	UT? 3 <lf>
Sample Response:	3,080 <lf> indicates that text buffer 3 is at position 80 (that is, 80 mm from the right edge).

✦ ***Position Event Marker***

The *Position Event Marker Command* allows you to define the position of each event marker.

Command:	[UE] [n],[r] [*]
Parameters:	n = event number (1 to 8) r = millimeters from right edge (8 to 207; 0 for off)
Example:	UE 3,80 <lf> places event marker 3 at position 80 (that is, 80 mm from the right edge).

The *Event Marker Position Query* requests the position of an event marker.

Query:	[UE?] [n] [*]
Parameters:	n = event number (1 to 8)
Valid Responses:	millimeters from right edge (8 to 207; 0 for off)

Example:	UE? 3 <lf>
Sample Response:	3,080 <lf>
	indicates that event marker 3 is at position 80 (that is, 80 mm from the right edge).

✦ ***DEFINE USER GRID***

The *Define User Grid Command* allows you to enable or disable printing of the major and minor chart grids.

Command:	[UG] [n],[x],[y] [*]
Parameters:	n = channel number (1 to 8)
	x = G for major grid
	x = M for minor grid
	y = 0 for off (disable printing of grid)
	y = 1 for on (enable printing of grid)
Example:	UG 3,G,0 <lf>
	disables printing of the major grid for channel 3.

The *User Grid Query* requests whether grids will print.

Query:	[UG?] [n],[x] [*]
Parameters:	n = channel number (1 to 8)
	x = G for major grid
	x = M for minor grid
Valid Responses:	n,x,y
	where: y = 0 for off
	y = 1 for on
Example:	UG? 3,G <lf>
Sample Response:	3,G,0 <lf>
	indicates printing of the major grid for channel 3 is disabled (off).

Note: The custom settings override standard settings. For example, the GR and GM Commands have no effect on the custom chart.

✦ *Define Signal Size*

The *Define Signal Size Command* defines the size of each waveform printed on the chart. The choice of a waveform size is determined by the number of channels that will be recording. That is, the more channels, the smaller the size of each channel.

If the size selected exceeds the minimum and maximum position of the channel (see Table 3-9), the waveform's position defaults to the minimum for that size. Therefore, you should define the signal size first and then position it.

If grids are enabled for a channel, a grid matched to the size of the waveform is automatically printed. Actual measurement of the grids depends upon the software package you are using, as shown in Table 3-8.

Command:	[US] [n],[s] [*]
Parameters:	n = channel number (1 to 8)
	s = 1 for 1-channel grid
	s = 2 for 2-channel grid
	s = 4 for 4-channel grid
	s = 6 for 6-channel grid
	s = 8 for 8-channel grid
	s = M for mini-channel grid
Example:	US 2,2 <lf>
	sets the size of channel 2 to the size indicated in Table 3-8 for a 2-channel grid, in this case one half of the chart.

Table 3-8: Waveform/Grid Sizes

# of Channels	*Size of Channels*	
	Packages 1,2,3	*Packages 4,5*
Mini	12.5 mm	10 mm
8	21.875 mm	20 mm
6	28.125 mm	25 mm
4	43.75 mm	40 mm
2	87.5 mm	100 mm
1	175 mm	200 mm

The *Signal Size Query* requests the size of a waveform on the chart.

Query:	[US?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	n,s where: s = 1 for 1-channel grid s = 2 for 2-channel grid s = 4 for 4-channel grid s = 6 for 6-channel grid s = 8 for 8-channel grid s = M for mini-channel grid
Example:	US? 2 <lf>
Sample Response:	2,2 <lf> indicates the size of channel 2 is the size indicated in Table 3-8 for a 2-channel grid, in this case one half of the chart.

✦ Position Channel

The *Position Channel Command* allows you to define the center position of a channel and waveform. This command does *not* control zero position: it controls the placement of the entire channel grid and waveform.

Command:	[UC] [n],[p] [*]
Parameters:	n = channel number (1 to 8) p = millimeters from right edge (See Table 3-9 for valid ranges.)
Example:	UC 2,103 <lf> places center of channel 2 at position 103 (that is, 103 mm from the right edge).

Table 3-9: Channel Position Ranges

Size	*Range for Center Position*	
	Packages 1,2,3	*Packages 4,5*
1	110 mm	110 mm
2	58 to 161 mm	58 to 161 mm
4	31 to 188 mm	28 to 188 mm
6	21 to 198 mm	19 to 198 mm
8	17 to 202 mm	17 to 201 mm
M	11 to 208 mm	12 to 207 mm

The *Channel Position Query* requests the center position of a channel, including waveform.

Query:	[UC?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	millimeters from right edge (always 3 ASCII digits)
Example:	UC? 2 <lf>
Sample Response:	2,103 <lf> indicates that the center of channel 2 is at position 103 (that is, 103 mm from the right edge).

The ***Analog Setup Commands*** allow the host to modify the analog settings for each individual channel, automatically calibrate the system, and set up for auto-range. Table 3-10a and 3-10b list the Analog Setup commands and queries.

✦ ***GROUND***

The *Ground Command* changes the status of any one of the analog channels to either signal in or ground. That is, it specifies to either accept or ground the channel's input signal.

Command:	[GD] [n],[x] [*]
Parameters:	n = channel number (1 to 8)
	x = 0 for ground
	x = 1 for signal in
Example:	GD 8,1 <lf>
	specifies signal in for channel 8.

The associated *Ground Query* requests whether the status of any one of the analog channels is signal in or ground.

Command:	[GD?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	n,x
	with: 0 for ground
	1 for signal in
Example:	GD? 3 <lf>
Sample Response:	3,0 <lf>
	specifies that channel 3 is grounded.

✦ ***AUTOMATIC CALIBRATION***

The *Analog Channel Calibration Command* causes the DASH 8 to perform an automatic and extremely accurate gain self-calibration for all analog channels. This procedure tests and corrects the baseline offset for each range.

Command:	[CA] [*]
Parameters:	none
Example:	CA <lf>

Table 3-10a: Analog Setup Commands

Header	*Function*
GD	Specify signal in or ground for an analog channel
CA	Calibrate all analog channels
NC	Define numeric calibration
AS	Enable/disable auto-range for a channel
AT	Set auto-range sampling time
AR	Perform auto-ranging
RS	Set full-scale volt range
ZE	Position zero volts (ground) on chart
ZS	Set units of zero suppression
MS	Specify whether input is peak to peak or RMS
FS	Enable/disable 10Hz low-pass filter for a channel
CR	Enable/disable signal conditioner reporting

Table 3-10b: Analog Setup Queries

Header	*Function*
GD?	Is the signal in or grounded for an analog channel?
CA?	Calibrate all analog channels and return status
NC?	How is numeric calibration defined?
AS?	Is auto-range enabled for a channel?
AT?	What is the auto-range sampling time?
RS?	What is the full-scale volt range?
ZE?	Where is zero volts (ground) positioned on the chart?
ZS?	How many units of zero suppression are set?
MS?	Is input peak-to-peak or RMS?
FS?	Is the 10Hz low-pass filter enabled for a channel?
CR?	Is signal conditioner reporting enabled?

When calibration is done, the DASH 8 sets the "Operation Complete" bit in the status byte to 1 (on). You can request the status byte by issuing the Status Request (QS) Query or by performing a serial poll, both described in Chapter 2.

If you send the Calibration Command as a query, the DASH 8 performs the calibration and responds with a pass/fail message.

Query:	[CA?] [*]
Parameters:	none
Valid Responses:	PASSED or FAILED (for specific channels)
Example:	CA? <lf>
Sample Response:	FAILED 2,4<lf> indicates that calibration was performed, but failed for channels 2 and 4.

✦ ***NUMERIC CALIBRATION***

The *Numeric Calibration Command* defines the calibration for each channel in the numeric output modes, Data Logger and Numeric Playback. (This calibration does not adjust automatically upon a change in the volts command.) The conversion factors represent the values of the left and right edges of the waveform in the selected channel. These values are used to convert the waveform data into tabular numeric columns of data.

With this command you specify the left edge value and sign, the right edge value and sign, and the exponent and sign.

Command:	[NC] [n],[lv],[ls],[rv],[rs],[e],[s] [*]
Parameters:	n = channel number (1 to 8) lv, rv = four-digit integer (0000 to 9999) ls, rs = sign (+ or -) e = one-digit integer exponent (0 or 1) s = sign of exponent (controls decimal placement)
Example:	NC 1,5000,+,5000,-,1,+ <lf> specifies +50,000 to -50,000 degrees for channel 1.

The associated *Numeric Calibration Query* requests the numeric settings for a particular channel in the numeric output modes.

Query:	[NC?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	n,lv,ls,rv,rs,e,s where lv, rv = four-digit integer (0000 to 9999) ls, rs = sign (+ or -) e = one-digit integer exponent (0 or 1) s = sign of exponent (controls decimal placement)
Example:	NC? 3 <lf>
Sample Response:	3,0200,-,0200,+,1,+ <lf> provides the numeric settings for channel 3.

Auto-Range

The auto-range feature allows the DASH 8 to automatically set the range for any input signal. When the Auto-Range Command is sent, the DASH 8 samples a signal for a time interval long enough to provide a true picture of the maximum range, eliminating the chance of out-of-range recording.

You determine via separate host control commands the channels for which auto-range is available and the time interval to be used for signal sampling.

The DASH 8 samples an input signal three times, each time obtaining the minimum and maximum voltages that represent the full-scale excursion on the chart. The time period can be from 1 to 99 seconds, ensuring that almost any waveform can be sampled long enough to obtain an accurate picture of its maximum range. Since three iterations of the sample period are required, the total sampling time will be three times the selected time duration.

Note: The waveform must be an AC signal and have a minimum excursion of 50 millivolts. DC signals cannot be auto-ranged.

The following three commands control the auto-range function.

✦ *Select Auto-Range Channels*

The *Select Channels Command* enables or disables auto-ranging for particular channels.

Command:	[AS] [n],[x] [*]
Parameters:	n = channel number (1 to 8)
	x = 0 to disable auto-range
	x = 1 to enable auto-range
Example:	AS 3,1 <lf>
	enables auto-range for channel 3.

The *Select Channels Query* requests whether auto-range is enabled or disabled for a particular channel.

Query:	[AS?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	0 for auto-range disabled
	1 for auto-range enabled
Example:	AS? 3 <lf>
Sample Response:	3,1 <lf>
	indicates auto-range is enabled for channel 3.

✦ *Select Time Duration*

The *Select Time Duration Command* sets the time interval for signal sampling for all channels. Note that short durations, combined with low input signal frequency, can cause an inaccurate auto-range. The duration should be determined for the channel with the lowest input frequency.

Command:	[AT] [x] [*]
Parameters:	x = duration in seconds (1 to 99)
Example:	AT 10 <lf>
	sets the time interval for signal sampling to 10 seconds.

The *Time Duration Query* requests the time interval for signal sampling for all channels.

Query:	[AT?] [*]
Parameters:	none
Valid Responses:	the time duration in seconds (always 2 ASCII digits)
Example:	AT? <lf>
Sample Response:	10 <lf> indicates time interval for signal sampling is 10 seconds.

✦ ***PERFORM AUTO-RANGE*** The *Perform Auto-Range Command* starts the auto-range procedure for all channels for which auto-range is enabled. The process can be aborted by issuing the Exit (EX) Command; range settings will remain as previously set.

When auto-range is done, the DASH 8 sets the "Operation Complete" bit in the status byte to 1 (on). You can request the status byte by issuing the Status Request (QS) Query or by performing a serial poll, both described in Chapter 2.

Command:	[AR] [*]
Parameters:	none
Example:	AR <lf> starts the auto-range procedure.

Note: During the auto-range process, certain commands are disallowed because they would corrupt the auto-range. These commands are: GD, CA, AS, AT, AR, ZE, ZS, RS, MS, FS, LP, DL, AC, TB, HS, PV, RT, PB, UP, DB, FF. If you issue any of these commands, an execution error occurs, the command is ignored, and the DASH 8 sets the "Execution Error" bit in the status byte to 1 (on). You can request the status byte by issuing the Status Request (QS) Query or by performing a serial poll.

Queries for these commands, however, will generate responses (with the exception of the Calibrate (CA?) Query since it causes a calibration to be performed.

✦ RANGE

The *Range Command* allows you to specify the full-scale input range for each channel. The range determines the signal sensitivity (gain) for proper full-scale input to the recorder. In turn the signal sensitivity determines the amplitude of the signal displayed, that is, the number of units per division on the chart paper.

Command:	[RS] [n],[x],[u] [*]
Parameters:	n = the channel number (1 to 8)
	x = the range in volts or millivolts (See Table 3-11.)
	u = v for volts
	u = mv for millivolts
Example:	RS 7,310,mv <lf>
	sets the range for channel 7 to 310 millivolts full scale.

Table 3-11: Full-Scale Input Ranges

Volt Ranges

5.0 to 20.0 volts in .1-volt increments
20.2 to 50.0 volts in .2-volt increments
50.5 to 100.0 volts in .5-volt increments
101.0 to 200.0 volts in 1-volt increments
202.0 to 500.0 volts in 2-volt increments

Millivolt Ranges

50 to 200 millivolts in 1-millivolt increments
202 to 500 millivolts in 2-millivolt increments
505 to 1000 millivolts in 5-millivolt increments
1010 to 2000 millivolts in 10-millivolt increments
2020 to 5000 millivolts in 20-millivolt increments

The *Range Query* requests the full-scale input range for a channel.

Query:	[RS?] [n] [*]
Parameters:	n = the channel number (1 to 8)
Valid Responses:	the range in volts or millivolts (always 4 ASCII digits)
Example:	RS? 7 <lf>
Sample Response:	7,0310,mv
	indicates that the range for channel 7 is 310 millivolts full scale.

✦ *Zero Position*

The *Zero Position Command* defines the position of 0 volts (ground) on the chart. To position zero volts, you specify a percentage of full scale up to +/- 75%, with 0% representing the center of the chart, +50% the top edge, and -50% the bottom edge. In effect, this positions the waveform within the channel.

Thus, the baseline can be positioned above or below the grid, using the over-range built into each channel.

Command:	[ZE] [n],[x] [*]
Parameters:	n = channel number (1 to 8) x = percentage from -75% to +75% in .1% increments (The sign must immediately precede the percentage; if no sign is entered, a positive percentage is assumed.)
Example:	ZE 3,24.3 <lf> places zero position at 24.3% of full scale from the center of Channel 3.

The associated *Zero Position Query* requests the position of 0 volts (ground) on the chart.

Query:	[ZE?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	n,x where: n = channel number (1 to 8) x = percentage from -75% to +75% in .1% increments (x is always 5 ASCII digits.)
Example:	ZE? 3 <lf>
Sample Response:	3,+24.3 <lf> indicates that zero position is at 24.3% of full scale from the center of Channel 3.

✦ *Zero Suppression*

The *Zero Suppression Command* allows you to to adjust the zero suppression for the selected channel by specifying the number of volts or millivolts you wish suppressed. For example, zero suppression allows you to eliminate a dominant and unwanted direct current (DC) component of the signal so that you can expand the portion of the AC signal that is of interest and move the output waveform anywhere on the chart. That is, you can determine a new baseline value and then position the waveform where you like.

If you wish to suppress a positive voltage, specify a negative zero suppression value; if you wish to suppress a negative voltage, specify a positive zero suppression value.

Command:	[ZS] [n],[x] [*]
Parameters:	n = channel number (1 to 8) x = +500.0 to -500.0 in .5-volt increments (volt range) or x = +10.000 to -10.000 in .005-volt increments (millivolt range) (The sign must immediately precede the number; if no sign is entered, a positive number is assumed.)
Example:	ZS 3,-91.5 <lf> sets the zero suppression for channel 3 to -91.5 volts.

The *Zero Suppression Query* requests the number of volts or millivolts suppressed for a selected channel.

Query:	[ZS?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	+500.0 to -500.0 in .5-volt increments or +10.000 to -10.000 in .005-volt increments (including leading zeros)
Example:	ZS? 3 <lf>
Sample Response:	3,-091.5 <lf> indicates that zero suppression for channel 3 is set for -91.5 volts.

Note: Zero suppression is not available with the MOD2 version of the DASH 8 Recorder.

✦ *Mode*

The *Mode Command* specifies type of input: peak to peak or RMS.

Command:	[MS] [n],[x] [*]
Parameters:	n = the channel number (1 to 8)
	x = 0 for peak to peak
	x = 1 for RMS
Example:	MS 2,0 <lf>
	sets the mode for channel 2 to peak to peak.

The *Mode Query* requests the type of input for a channel.

Command:	[MS?] [n] [*]
Parameters:	n = the channel number (1 to 8)
Valid Responses:	0 for peak to peak
	1 for RMS
Example:	MS? 2 <lf>
Sample Response:	2,0
	indicates that the mode for channel 2 is peak to peak.

Note: Mode selection is not available with the MOD2 version of the DASH 8 Recorder.

✦ *Filter*

The *Filter Command* allows you to enable or disable the 10-Hertz low-pass filter for the selected channel. Filtering is used to eliminate unwanted high frequency components of the signal, helping to refine final output.

Command:	[FS] [n],[x] [*]
Parameters:	n = the channel number (1 to 8)
	x = 0 for filter off
	x = 1 for filter on
Example:	FS 2,0 <lf>
	turns off the 10-hertz low-pass filter for channel 2.

The *Filter Query* requests whether the 10-Hertz low-pass filter is on or off for a selected channel.

Query:	[FS?] [n] [*]
Parameters:	n = the channel number (1 to 8)
Valid Responses:	0 for filter off
	1 for filter on
Example:	FS? 2 <lf>
Sample Response:	2,0 <lf>
	turns off the 10-hertz low-pass filter for channel 2.

✦ ***Signal Conditioner Reporting***

The *Signal Conditioner Reporting Command* defines which channels will have signal conditioner reporting in the last 38 characters of the interchannel annotation buffer. Reporting includes information on the full-scale range, units of zero suppression, and filter status.

Command:	[SC] [n],[x] [*]
Parameters:	n = channel number (1 to 8)
	x = 0 for off
	x = 1 for on
Example:	SC 2,1 <lf>
	enables signal conditioner reporting on channel 2.

The associated *Signal Conditioner Reporting Query* requests whether signal conditioner reporting is active for a particular channel.

Query:	[SC?] [n] [*]
Parameters:	n = channel number (1 to 8)
Valid Responses:	n,0 for off
	n,1 for on
Example:	SC? 2 <lf>
Sample Response:	2,1 <lf>
	indicates signal conditioner reporting is on for channel 2.

Acquire Setup

The ***Acquire Setup Commands*** determine how an acquisition (data capture) is to be performed. Tables 3-12a and 3-12b list the Acquire Setup commands and queries. For more information on data capture and playback, refer to the *DASH 8 Operations Manual.*

Table 3-12a: Acquire Setup Commands

Header	*Function*
SR	Set the sample rate for data capture
TW	Specify the trigger/window relationship for data capture
AM	Specify how data is to be stored: normal (32Ksamples per channel) or segmented (eight 4-Ksample records per channel)

Table 3-12b: Acquire Setup Queries

Header	*Function*
SR?	What is the sample rate for data capture?
TW?	What is the trigger/window relationship for data capture?
AM?	How is data to be stored: normal or segmented?

Note: The DASH 8 Recorders require installation of the DC-85 Data Capture option to perform any data capture or playback.

✦ ***Sample Rate*** The *Sample Rate Command* allows you to change the sample rate for data capture. The DASH 8 can sample data up to 250 kHz per channel. The rate should be at least 10 times the input frequency.

Command:	[SR] [x] [*]
Parameters:	x = 0 for 250 kHz
	x = 1 for 100 kHz
	x = 2 for 50 kHz
	x = 3 for 10 kHz
	x = 4 for 5 kHz
	x = 5 for 1 kHz
	x = 6 for 500 hz
	x = 7 for 100 hz
Example:	SR 1 <lf>
	sets the sample rate to 100 kHz per channel.

The *Sample Rate Query* requests the sample rate for data capture.

Query:	[SR?] [*]
Parameters:	none
Valid Responses:	0 for 250 kHz
	1 for 100 kHz
	2 for 50 kHz
	3 for 10 kHz
	4 for 5 kHz
	5 for 1 kHz
	6 for 500 hz
	7 for 100 hz
Example:	SR? <lf>
Sample Response:	1 <lf>
	indicates the sample rate is set to 100 kHz per channel.

✦ ***Trigger/ Window Relation*** The *Trigger/Window Relation Command* allows you to specify how you want analog data to be stored in the DASH 8's circular buffer (window) during data capture. Choices range from 0% to 100% pre-trigger data, with the remainder of the window containing the post-trigger data.

Command:	[TW] [x] [*]
Parameters:	x = 0 to 100% in 10% increments
Example:	TW 50 <lf> sets the trigger/window relation to 50% so that the DASH 8 will capture one half of the data that occurred before the trigger and one half after the trigger.

The *Trigger/Window Relation Query* requests the pre-trigger and post-trigger relation during data capture.

Query:	[TW?] [*]
Parameters:	none
Valid Responses:	0 to 100% in 10% increments (always 3 ASCII digits)
Example:	TW? <lf>
Sample Response:	050 <lf> indicates the trigger/window relation to be 50%.

✦ ***Acquisition Type*** The *Acquisition Type Command* allows you to specify how you want analog data to be stored during data capture. The acquisition can be normal or segmented. Normal data capture allows one 32-kilosample segment to be captured per channel. Segmented data capture allows eight separate 4-kilosample records to be captured per channel.

Note: It is best to select and set up the acquisition type once and to consistently perform data capture and playback in that type. If, for example, acquisition type is set to normal and then a data playback command is sent specifying a segmented playback, the results will be inaccurate.

Also, when this command is sent, data capture information is initialized. So be aware that your data will be affected.

Command:	[AM] [x] [*]
Parameters:	x = 0 for normal
	x = 1 for segmented
Example:	AM 1 <lf>
	specifies that data is to be stored in the segmented format.

The *Acquisition Type Query* requests how analog data is stored during data capture.

Query:	[AM?] [*]
Parameters:	none
Valid Responses:	0 for normal
	1 for segmented
Example:	AM? <lf>
Sample Response:	1 <lf>
	indicates that segmented acquisition is selected.

TRIGGER SETUP

The ***Trigger Setup Commands*** define the source, characteristics, and uses of triggers during recorder operation. Refer to the *DASH 8 Operations Manual* for detailed information about DASH 8 triggers. Tables 3-13a and 3-13b list the Trigger Setup commands and queries.

Table 3-13a: Trigger Setup Commands

Header	*Function*
TS	Define trigger source
TA	Associate channels in an "and" relationship
TO	Associate channels or groups of channels in an "or" relationship
TL	Define trigger level and slope
TE	Establish a trigger to occur at periodic intervals

Table 3-13b: Trigger Setup Queries	
Header	*Function*
TS?	What are the trigger source(s)?
TA?	Which channels are associated in an "and" relationship in a particular group?
TO?	Which groups are associated in an "or" relationship?
TL?	What is the level and slope for an analog trigger?
TE?	At what time intervals will a timed trigger occur?

✦ TRIGGER SOURCE

The *Trigger Source Command* defines the active source of a trigger, which is a mechanism that enables the recorder either to begin operation or alter operation in response to various stimuli. Trigger sources fall in five main categories:

- Manual — initiated via the Trigger Key on the DASH 8 front panel
- External — generated by TTL pulse or switch closure through the utility D-shell on the DASH 8 rear panel
- Bus — initiated from the host through the GPIB D-shell on the DASH 8 rear panel
- Analog — sensed in the rise and/or fall of signal levels in selected analog channels
- Timed — generated automatically and continuously at specified time intervals

Command: [TS] [x] [*]
Parameters: x = 1 for manual trigger
x = 2 for external trigger
x = 3 for bus (GPIB) trigger
x = 4 for analog triggers
x = 5 for timed trigger
Example: TS 1,2,5 <lf>
enables external, manual, and timed triggers (in an "or" relationship). That is, any of these conditions individually will cause a trigger.

The associated *Trigger Source Query* requests the active source of a trigger.

Query:	[TS?] [*]
Parameters:	none
Valid Responses:	1 for manual 2 for external 3 for host 4 for analog 5 for timed
Example:	TS? <lf>
Sample Response:	1,2,5 <lf> indicates that external, manual, and timed triggers are enabled.

Trigger Logic

The following two commands permit the application of "and/or" logic to establishing triggers. An expanded discussion of trigger logic can be found in the *DASH 8 Operations Manual.*

The "And" Channel Command allows you to identify groups containing from one to eight channels by a particular letter from A to H. Channels grouped in this manner must *all* satisfy a condition in order for a trigger to occur.

The "Or" Channel Command can then be used to connect these groups through "or" logic, thereby producing the final trigger equation. Groups related in this manner can *individually* satisfy a condition in order for a trigger to occur. Though slightly complex, using "and/or" logic in this manner permits a large number of analog trigger combinations.

✦ ***"AND" CHANNEL***

The *"And" Channel Command* specifies which channels are grouped together as trigger sources.

Command:	[TA] [n],[s] [*]
Parameters:	n = group identifier (A to H) s = channels (1 to 8) to be grouped, entered as a string and separated by commas

Example: TA D,2,3,5 <lf>
identifies channels 2, 3, and 5 as analog triggers related with "and" logic and identified as group D.

In the example, channels 2, 3, and 5, when included in a final trigger equation with the "Or" Channel Command and identified as a trigger source through the Trigger Source Command, must *all* meet the trigger condition established by the Trigger Level/Slope Command in order for a trigger to occur.

The *"And" Channel Query* requests which channels are in a particular group.

Query:	[TA] [n] [*]
Parameters:	n = group identifier (A to H)
Valid Responses:	1 to 8 (channels in the group, displayed as a string)
Example:	TA? D <lf>
Sample Response:	D,2,3,5 <lf> indicates that channels 2, 3, and 5 are analog triggers identified as group D.

✦ "Or" Channel

The *"Or" Channel Command* specifies which groups of analog channels will be associated with "or" logic. Remember that the channels within the group are related with "and" logic; the groups themselves are related with "or" logic.

This command produces the final analog trigger equation to be used when analog triggers are activated by the Trigger Source Command.

Command:	[TO] [n] [*]
Parameters:	A to H (group identifiers entered as a string)
Example:	TO A,D <lf> establishes groups A and D as related with "or" logic.

In the example, if *either* group A *or* group D (when identified as a trigger source through the Trigger Source Command) meets the trigger condition established by the Trigger Level/Slope Command, a trigger will occur.

The *"Or" Channel Query* requests which groups of analog channels will be associated with "or" logic.

Query:	[TO] [*]
Parameters:	none
Valid Responses:	A to H (group identifiers entered as a string)
Example:	TO? <lf>
Sample Response:	A,D <lf> indicates that groups A and D are related with "or" logic.

✦ ***TRIGGER LEVEL/SLOPE***

If a trigger is to have an analog source, the *Trigger Level/Slope Command* defines the current setup of the analog trigger. That is, it defines the voltage levels at which the trigger occurs. The analog trigger itself will not become active unless an analog trigger has been selected and is part of the trigger equation. If selected, a trigger will occur when the signal crosses the trigger level. Levels are specified as percentages of full scale in 1% increments.

Command:	[TL] [n],[l],[h] [*]
Parameters:	n = the channel number (1 to 8) l = lower level [(higher level - 1%) to 0%] h = higher level [100% to (lower level + 1%)]
Example:	TL 1,40,75 <lf> indicates that a trigger can occur when channel 1 falls below 40% of full scale or exceeds 75%.

The associated *Trigger Level/Slope Query* requests the current setup of the analog trigger for a particular channel, that is, the voltage levels at which the trigger occurs.

Query:	[TL?] [n] [*]
Parameters:	n = the channel number (1 to 8)
Valid Responses:	n,l,h where n = the channel number (1 to 8) l = lower level (always 3 ASCII digits) h = higher level (always 3 ASCII digits)
Example:	TL? 1 <lf>
Sample Response:	1,040,075<lf> indicates that a trigger can occur when channel 1 falls below 40% of full scale or exceeds 75%.

✦ ***TIMED TRIGGER***

The *Timed Trigger Command* sets a trigger to occur periodically at a specified time interval.

Command:	[TE] [s] [*]
Parameters:	s = time string in "hh:mm:ss" format with quotation marks
Example:	TE "00:00:10" <lf> causes a trigger to occur every 10 seconds.

The *Timed Trigger Query* requests the time interval at which a timed trigger will occur.

Query:	[TE?] [*]
Parameters:	none
Valid Responses:	time string in "hh:mm:ss" format
Example:	TE? <lf>
Sample Response:	"00:00:10" <lf> indicates that a trigger will occur every 10 seconds.

PLAYBACK SETUP

The ***Playback Setup Commands*** determine how data will be played out on the chart during data playback. Tables 3-14a and 3-14b list the Playback Setup commands and queries. For more information on data capture and playback, refer to the *DASH 8 Operations Manual.*

Note: The DASH 8 Recorder requires installation of the DC-85 Data Capture option to perform any data capture or playback.

Table 3-14a: Playback Setup Commands

Header	*Function*
XY	Select x and y channels
MG	Specify reduction or magnification of playback
PP	Specify percentage of playback

Table 14b: Playback Setup Queries

Header	*Function*
XY?	Which channels are selected as x and y channels for x/y plotting of two captured signals?
MG?	What is the reduction or magnification of playback?
PP?	What is the percentage of data to be played back?

✦ X AND Y CHANNELS

The DASH 8 is capable of producing x/y plots of two captured signals. The *X and Y Channels Command* specifies which channel will be x and which will be y when plotted.

Command:	[XY] [x],[y] [*]
Parameters:	x = 1 through 8 for x channel
	y = 1 through 8 for y channel
Example:	XY 1,8 <lf>
	sets x and y to channels 1 and 8.

The associated *X and Y Channels Query* requests which channel will be x and which will be y during x/y plotting of two captured signals.

Query:	[XY?] [*]
Parameters:	none
Valid Responses:	x,y
	where x = 1 through 8 for x channel
	y = 1 through 8 for y channel
Example:	XY? <lf>
Sample Response:	1,8 <lf>
	indicates that channel 1 is x and channel 8 is y for an x/y plot playback.

✦ MAGNIFICATION

The *Magnification Command* expands or compresses data during playback. Normally, data is played back at times 1.

Command:	[MG] [x] [*]
Parameters:	x = 0 for times 1/8
	x = 1 for times 1/4
	x = 2 for times 1/2
	x = 3 for times 1
	x = 4 for times 2
	x = 5 for times 4
Example:	MG 4 <lf>
	magnifies the data by 2 times.

The associated *Magnification Query* requests the degree of data expansion or compression during playback.

Query:	[MG?] [*]
Parameters:	none
Valid Responses:	0 for times 1/8 1 for times 1/4 2 for times 1/2 3 for times 1 4 for times 2 5 for times 4
Example:	MG? <lf>
Sample Response:	4 <lf> indicates that data will play back magnified by 2.

✦ ***PLAYBACK PERCENTAGE***

The *Playback Percentage Command* alters the amount of playback data to be output on the chart. You specify a start point as a percentage and an end point as a percentage. A complete playback is defined as 0 to 100%.

Command:	[PP] [x],[y] [*]
Parameters:	x = 0 to y in 10% increments (start) y = x to 100 in 10% increments (end) x < y
Example:	PP 0,100 <lf> specifies full playback of acquired data.

The associated *Playback Percentage Query* requests the amount of playback data to be output on the chart.

Query:	[PP?] [*]
Parameters:	none
Valid Responses:	x,y where: x = 0 to y in 10% increments (start) y = x to 100 in 10% increments (end)
Example:	PP? <lf>
Sample Response:	000,100 <lf> indicates full playback of acquired data.

4 Operating Modes

From Idle Mode you can enter any of the modes of operation. Sections 4-1 through 4-4 describe the various modes, the commands that enter the recorder into each mode, and the commands that are available from within each mode.

Charts in these sections list the commands specific to each mode. Descriptions and examples of the commands are also provided. System setup commands are also available within the modes, with the exception of the Line Printer Mode, which must be exited before system commands are accepted. System setup commands are described in Chapter 3.

Table 4-1: DASH 8 Mode Entry Commands

Real-Time Recording Modes:	RT	Analog Real-Time Recorder
	DL	Data Logger
	TB	Timed Operation
	DB	Dual-Speed Operation
Data Capture and Playback Modes:	AC	Acquire (Data Capture)
	PM	Data Playback
Data Transfer Mode:	UP	Data Transfer
Additional Printing Mode:	LP	Line Printer

4-1 Real-Time Recording Modes

Analog Real-time Recorder Mode

The standard use and main operation of the DASH 8 Recorder is to be an analog stripchart recorder.

Send the following command from the host to the recorder to begin analog real-time recording and to specify the chart format for the DASH 8:

Command:	[RT] [x] [*] (where x is a chart format)
Parameters:	x = 1 for a one-grid format 8 signals, all overlapped
	x = 2 for a two-grid format 8 signals, 4 overlapped on each grid
	x = 4 for a four-grid format 8 signals, 2 overlapped on each grid
	x = 6 for a six-grid format 6 signals, 1 for each grid
	x = 8 for an eight-grid format 8 signals, 1 for each grid
	x = U for user format, based upon user chart setup parameters
Example:	RT 8<lf> informs the recorder to enter basic 8-channel mode.

Commands used to control operation while in Analog Real-Time Recorder Mode are listed in Table 4-2a. Associated queries are listed in Table 4-2b. A comparison of the tables reveals that most commands can also be sent as queries. The Analog Real-time Recorder commands and queries are fully described in this section.

All system commands and queries are fully described in Chapter 3, but they are also available while in the Analog Real-time Recorder Mode. Refer to Chapter 3 for descriptions and examples of these commands and queries.

Table 4-2a: Analog Real-Time Recorder Commands

Header	*Function*
ST	Start or stop the recorder output (toggle)
RU	Start recorder output
HA	Halt recorder output
SP	Change and set motor speed
ID	Label the waveforms with numeric identification
PC	Control printing of interchannel text buffers
PO	Print content of on-demand buffer
BC	Arm/disarm background data capture
EX	Exit Analog Real-time Recorder Mode to Idle Mode

Table 4-2b: Analog Real-Time Recorder Queries

Header	*Function*
ST?	Is the recorder currently running?
RU?	Is the recorder currently running?
HA?	Is the recorder currently running?
SP?	What is the current motor speed?
PC?	Are interchannel text buffers printing, and, if so, once or repeatedly?
PO?	Are the contents of the On-Demand Buffer currently printing?
BC?	Is background data capture armed or disarmed?

Analog Real-Time Recorder Commands and Queries

✦ ***Start/Stop*** The *Start/Stop Toggle Command* starts or stops the motor, thus controlling recorder chart output. This is a toggle command, meaning that the same command changes the recorder state from the one it is currently in to the other. That is, if the recorder is running, ST will stop it; if it is not running, ST will start it. (There are also separate RUN/HALT commands available.)

Command:	[ST] [*]
Parameters:	none
Example:	ST<lf>

The *Start/Stop Query* requests motor status, that is, whether or not the motor and chart are running.

Query:	[ST?] [*]
Parameters:	none
Valid Responses:	0 for motor is stopped
	1 for motor is running
Example:	ST? <lf>
Sample Response:	1 <lf>
	indicates that the motor is running.

✦ ***Run and Halt*** The *Run and Halt Commands* control the running of the recorder while in the Analog Real-Time Recorder Mode. This command is similar to the Start/Stop Toggle Command.

Command:	[RU] [*] or [HA] [*]
Parameters:	none
Example:	RU <lf>
	starts analog chart recording.

The *Run and Halt Queries* also request motor status, that is, whether or not the motor and chart are running. These three queries all request the same information and receive the same valid responses.

Query:	[RU?] [*] or [HA?] [*]
Parameters:	none
Valid Responses:	0 for motor is stopped 1 for motor is running
Example:	RU? <lf>
Sample Response:	1 <lf> indicates that the motor is running.

✦ ***SET/CHANGE MOTOR SPEED***

The *Set/Change Motor Speed Command* changes the current motor speed. The default speed is 25 millimeters per second (mm/sec); valid speeds are up to 200 mm/sec.

Command:	[SP] [x],[y] [*]
Parameters:	x is an integer from 1 to 200 y is the range: 1 for mm/second 2 for mm/minute 3 for mm/hour
Example:	SP 100,1<lf> sets the speed at 100 millimeters per second.

The *Motor Speed Query* requests the current motor speed.

Query:	[SP?] [*]
Parameters:	none
Valid Responses:	x,y where: x is an integer from 1 to 200 y is the range: 1 for mm/second 2 for mm/minute 3 for mm/hour
Example:	SP? <lf>
Sample Response:	100,1 <lf> indicates that the recorder speed is currently set at 100 millimeters per second.

Note: The maximum speed is 100 mm/sec for the MOD2 version of the DASH 8 Recorder.

✦ ***IDENTIFICATION***

The *Identification (ID) Command* causes a numeric ID to be printed immediately on each signal to clearly identify which trace represents which input signal. This is very useful during overlap recording.

Command:	[ID] [*]
Parameters:	none
Example:	ID <lf> causes channel identification to be printed immediately.

Note: Issuing this command is comparable to pressing the front-panel ID Key. To print the numeric ID repeatedly, use the Automatic identification Command (AI), which is described under system setup.

✦ ***PRINT INTERCHANNEL TEXT BUFFER***

The *Print Interchannel Text Buffer Command* controls whether and how the interchannel text buffers are printed in the analog record.

Command:	[PC] [x] [*]
Parameters:	x = 0 turns printing off x = 1 causes text buffers to be printed once x = 2 causes printing to be repeated
Example:	PC 1 <lf> causes text buffers to be printed once.

The *Interchannel Text Print Query* requests whether and how interchannel annotation is printing.

Query:	[PC?] [*]
Parameters:	none
Valid Responses:	0 for printing off 1 for printing one time 2 for printing repeatedly
Example:	PC? <lf>
Sample Response:	1 <lf> indicates that interchannel annotation is printing one time.

✦ ***PRINT ON-DEMAND BUFFER***

The *Print On-Demand Buffer Command* causes the content of the on-demand buffer to be printed immediately.

Command:	[PO] [*]
Parameters:	none
Example:	PO <lf> causes the contents of the on-demand buffer to be printed immediately one time.

The *Print On-Demand Buffer Query* requests whether the on-demand buffer has finished printing.

Query:	[PO?] [*]
Parameters:	none
Valid Responses:	0 for buffer finished printing 1 for buffer in process of printing
Example:	PO? <lf>
Sample Response:	0 indicates that the on-demand buffer has finished printing.

✦ ***BACKGROUND DATA CAPTURE***

The *Background Data Capture Command* arms or disarms the DC-85 data capture operation. (The DASH 8 must be equipped with the DC-85 Data Capture option in order to perform this function.)

The data capture feature allows the DASH 8 to record (capture) signals displayed during analog real-time recording. This enables you to view the chart representation of the signals as they occur, as well as to review representation of the signals in an expanded form at a later time.

The default condition whenever Analog Real-time Recorder Mode is entered is for the data capture feature to be disarmed. Use the BC command to turn this feature on and begin data capture.

Command:	[BC] [n],[r] [*]
Parameters:	n = 0 for disarm n = 1 for arm

r = 1 to 8 for record number, if data capture is set up to be segmented (Omit this parameter if data capture is set up as normal, via the Acquisition Type Command described in Chapter 3.)

Example: BC 1,3 <lf>
arms the DASH 8 for data capture to be stored in record 3.

After performing a data capture, you can send the Status Request Query (QS) to determine when a background capture has been completed.

Refer to the *Dash 8 Operations Manual* and to Section 4-2 in this manual for detailed information on data capture.

The *Background Data Capture Query* requests whether the DC-85 data capture operation is armed or disarmed. (Your recorder must be equipped with the DC-85 Data Capture option in order to perform data capture.)

Query: [BC?] [*]
Parameters: none
Valid Responses: n,r,t
where:
n = 0 for disarm
n = 1 for arm
r = 1 to 8 for record number or
N for normal
t = 0 for pre-trigger
t = 1 for post-trigger
Example: BC? <lf>
Sample Response: 1,3,0 <lf>
indicates that record number 3 is armed for data capture and is acquiring pre-trigger data.

✦ ***Exit Analog Real-Time Mode*** The *Exit Analog Real-Time Recorder Mode Command* ends analog real-time recording and returns the recorder to Idle Mode, where it awaits a new mode command header.

Command:	[EX] [*]
Parameters:	none
Example:	EX <lf>

Data Logger Mode

The DASH 8 Recorder has the capability to be an eight-channel data logger that outputs real-time data in numeric format according to the values specified by the Numeric Calibration Command during system setup. This command is described in Chapter 3, "System Setup."

The commands from the host when the recorder is in this mode are similar to those when the recorder is in Analog Real-time Recorder Mode. Refer to the *DASH 8 Operations Manual* for more information on the Data Logger Mode.

The *Enter Data Logger Mode Command* enters the DASH 8 into numeric format recording and sets the current data logging speed to the selected range.

In the Data Logger Mode, speed is determined in a different manner than in other modes. In other modes, speed is determined as millimeters of print per unit of time. In Data Logger mode, speed is determined as a line of data printed during a particular span of time. Data logging speed can be specified as a line of data printed every so many milliseconds, seconds, or minutes, up to a maximum speed of one line every 175 milliseconds.

To enter Data Logger Mode:

Command:	[DL] [x],[y] [*]	
Parameters:	x is an integer in the ranges specified	
	y = 1 for milliseconds	(175-999)
	y = 2 for seconds	(001-999)
	y = 3 for minutes	(001-999)
Example:	DL 190,1 <lf>	
	sets speed at one line every 190 milliseconds.	

The *Data Logger Query* requests the current data logging speed.

Query:	[DL?] [*]
Parameters:	none

Valid Responses:	x,y where x is an integer in the ranges specified y = 1 for milliseconds (175-999) y = 2 for seconds (001-999) y = 3 for minutes (001-999)
Example:	DL? <lf>
Sample Response:	190,1 <lf> indicates that the current data logging speed is one line every 190 milliseconds.

Note: If the Data Logger Query is sent while the DASH 8 is not in Data Logger Mode, a 0 is returned to indicate Idle Mode.

All of the commands used in Data Logger Mode and their functions are listed in Table 4-3a. Associated queries are listed in Table 4-3b. A comparison of the tables reveals that most commands can also be sent as queries. The Data Logger commands and queries are fully described in this section.

All system commands and queries are fully described in Chapter 3, but they are also available while in Data Logger Mode. Refer to Chapter 3 for descriptions and examples of these commands.

Data Logger Commands and Queries

✦ ***Start/Stop*** The *Start/Stop Toggle Command* starts or stops the motor, thus controlling numeric data logging output. This is a toggle command, meaning that the same command changes the recorder state from the one it is currently in to the other. That is, if the recorder is running, ST will stop it; if it is not running, ST will start it. (There are also separate RUN/HALT commands available.)

Command:	[ST] [*]
Parameters:	none
Example:	ST <lf>

Table 4-3a: Data Logger Commands	
Header	*Function*
ST	Start or stop the recorder output (toggle)
RU	Start recorder output
HA	Halt recorder output
BC	Arm/disarm background data capture
EX	Exit Data Logger Mode to Idle Mode

Table 4-3b: Data Logger Queries	
Header	*Function*
ST?	Is the recorder currently running?
RU?	Is the recorder currently running?
HA?	Is the recorder currently running?
BC?	Is background data capture armed or disarmed?

The *Start/Stop Query* requests motor status, that is, whether or not the motor and chart are running.

Query:	[ST?] [*]
Parameters:	none
Valid Responses:	0 for motor is stopped 1 for motor is running
Example:	ST? <lf>
Sample Response:	1 <lf> indicates that the motor is running.

✦ ***RUN AND HALT***

The *Run and Halt Commands* control the running of the recorder while in Data Logger Mode. This command is similar to the Start/Stop Toggle Command.

Command:	[RU] [*] or [HA] [*]
Parameters:	none

Example: RU <lf>
starts data logger real-time numeric recording.

The *Run and Halt Queries* also request motor status, that is, whether or not the motor and chart are running. These three queries all request the same information and receive the same valid responses.

Query:	[RU?] [*] or [HA?] [*]
Parameters:	none
Valid Responses:	0 for motor is stopped
	1 for motor is running
Example:	RU? <lf>
Sample Response:	1 <lf>
	indicates that the motor is running.

✦ ***Background Data Capture***

The *Background Data Capture Command* arms or disarms the DC-85 data capture operation. (The DASH 8 must be equipped with the DC-85 Data Capture option in order to perform this function.)

The data capture feature allows the DASH 8 to record (capture) signals displayed during data logger real-time recording. This enables you to view the numeric representation of the signals as they occur, as well as to review representation of the signals in an expanded form at a later time.

The default condition whenever Data Logger Mode is entered is for the data capture feature to be disarmed. Use the BC command to turn this feature on and begin data capture.

Command:	[BC] [n],[r] [*]
Parameters:	n = 0 for disarm
	n = 1 for arm
	r = 1 to 8 for record number, if data capture is set up to be segmented (Omit this parameter if data capture is set up as normal, via the Acquisition Type Command described in Chapter 3.)

Example: BC 1 <lf>
arms the DASH 8 for normal data capture.

After performing a data capture, you can send the Status Request Query (QS) to determine when a background capture has been completed.

Refer to the *Dash 8 Operations Manual* and to Section 4-2 in this manual for detailed information on data capture.

The *Background Data Capture Query* requests whether the DC-85 data capture operation is armed or disarmed. (Your recorder must be equipped with the DC-85 Data Capture option in order to perform data capture.)

Query: [BC?] [*]
Parameters: none
Valid Responses: n,r,t
where:
n = 0 for disarm
n = 1 for arm
r = 1 to 8 for record number or
N for normal
t = 0 for pre-trigger
t = 1 for post-trigger
Example: BC? <lf>
Sample Response: 1,N,1 <lf>
indicates that the DASH 8 is armed for normal data capture and is acquiring post-trigger data.

✦ *Exit Data Logger Mode*

The *Exit Data Logger Mode Command* ends data logger numeric real-time recording and returns the recorder to the Idle Mode, where it awaits a new mode command header.

Command: [EX] [*]
Parameters: none
Example: EX <lf>

Timed Operation

Timed operation allows the DASH 8 to be set up to automatically operate between a predefined start time and end time at the speed and in the format specified. Once timed operation has begun, the front panel of the DASH 8 is locked, except for the Local Key.

You activate timed operation simply by issuing the Start Timed Operation (TB) Command. When timed operation begins, it will be in the format selected via the Timer Format (TF) Command. The other timed operation commands set up the conditions for timed operation.

Timed Operation Commands and Queries

Table 4-4a: Timed Operation Commands

Header	*Function*
TT	Set start time
TP	Set stop time
TD	Set timer speed
TF	Select format for timed output
TB	Start timed operation

Table 4-4b: Timed Operation Queries

Header	*Function*
TT?	What is the start time for timed operation?
TP?	What is the stop time for timed operation?
TD?	What is the speed during timed operation?
TF?	What is the format for timed output?
TB?	Is timed operation in process?

✦ SET START TIME

The *Set Start Time Command* specifies the time at which timed recorder operation is to begin. Time is indicated in a 24-hour format.

Command:	[TT] [s] [*]
Parameters:	s = time string in "mm/dd/yy,hh:mm:ss" format, where: mm/dd/yy = the date on which timed operation is to begin hh:mm:ss = the time at which timed operation is to begin
Example:	TT "11/11/91,12:30:00" <lf> sets the start date and time to November 11, 1991 at 12:30 p.m.

The *Start Time Query* requests the time at which timed recorder operation is to begin.

Query:	[TT?] [*]
Parameters:	none
Valid Responses:	mm/dd/yy,hh:mm:ss
Example:	TT? <lf>
Sample Response:	"11/11/91,12:30:00" indicates that the start date and time for timed operation is November 11, 1991 at 12:30 p.m.

✦ SET STOP TIME

The *Set Stop Time Command* specifies the time at which timed recorder operation is to end. Time is indicated in a 24-hour format.

Command:	[TP] [s] [*]
Parameters:	s = time string in "mm/dd/yy,hh:mm:ss" format, where: mm/dd/yy = the date on which timed operation is to end hh:mm:ss = the time at which timed operation is to end
Example:	TP "11/11/91,13:30:00" <lf> sets the stop date and time to November 11, 1991 at 1:30 p.m.

The *Stop Time Query* requests the time at which timed recorder operation is to end.

Query:	[TP?] [*]
Parameters:	none
Valid Responses:	mm/dd/yy,hh:mm:ss
Example:	TP? <lf>
Sample Response:	"11/11/91,13:30:00" indicates that the stop date and time for timed operation is November 11, 1991 at 1:30 p.m.

✦ ***SET TIMER SPEED***

The *Set Timer Speed Command* determines the speed of recorder output while under timed operation.

Command:	[TD] [x],[y] [*]
Parameters:	x = 1 to 200* to represent speed in millimeters per unit of time y = 1 for millimeters per second y = 2 for millimeters per minute y = 3 for millimeters per hour If in Data Logger Mode: x = lines per unit of time in the ranges specified y = 1 for milliseconds (175-999) y = 2 for seconds (001-999) y = 3 for minutes (001-999)
Example:	TD 25,1 <lf> sets the speed for 25 millimeters per second during timed operation.

* The MOD2 version of the DASH 8 Recorder has a maximum speed of 100 millimeters per second.

The *Timer Speed Query* requests the speed of recorder output while under timed operation.

Query:	[TD?] [*]
Parameters:	none
Valid Responses:	x,y where: x = speed in millimeters or lines y = unit of time
Example:	TD? <lf>
Sample Response:	25,1 indicates that the speed during timed operation is set for 25 millimeters per second.

✦ **SET TIMER FORMAT**

The *Timer Format Command* specifies the format for recorder output during timed operation.

Command:	[TF] [x] [*]
Parameters:	x = 1 for a one-grid format 8 signals, all overlapped x = 2 for a two-grid format 8 signals, 4 overlapped on each grid x = 4 for a four-grid format 8 signals, 2 overlapped on each grid x = 6 for a six-grid format 6 signals, 1 for each grid x = 8 for an eight-grid format 8 signals, 1 for each grid x = U for user format, based upon user chart setup parameters x = D for Data Logger format
Example:	TF 8 <lf> specifies eight-grid format during timed operation.

The *Timer Format Query* requests the format used for recorder output during timed operation.

Query:	[TF?] [*]
Parameters:	none
Valid Responses:	x = 1 for a one-grid format x = 2 for a two-grid format x = 4 for a four-grid format x = 6 for a six-grid format x = 8 for an eight-grid format x = U for user format x = D for Data Logger format
Example:	TF? <lf>
Sample Response:	8 <lf> indicates eight-grid format during timed operation.

✦ *START TIMED OPERATION*

The *Start Timed Operation Command* activates timed operation of the DASH 8 Recorder. When the start time specified equals the current time, recording will begin in the format specified by the TF Command and will continue until the specified stop time is reached.

Command:	[TB] [*]
Parameters:	none
Example:	TB <lf> activates timed operation.

The *Start Timed Operation Query* requests the status of timed operation for the DASH 8.

Query:	[TB?] [*]
Parameters:	none
Valid Responses:	0 = timed operation not active 1 = DASH 8 waiting for start time 2 = DASH 8 waiting for stop time
Example:	TB? <lf>
Sample Response:	1 <lf> indicates that the DASH 8 is waiting for the start time to begin timed operation.

Dual-Speed Operation

Dual-speed operation allows the DASH 8 to be set up to automatically toggle between two different chart speeds while operating in a real-time recording mode. The switch from one speed to the other can be initiated either in response to a trigger or to a specific time.

You initiate dual-speed operation simply by issuing the Start Dual-Speed Operation (DB) Command. Dual-speed operation will begin immediately in the format selected via the Dual-Speed Format (DM) Command. The other dual-speed commands set up the conditions for dual-speed operation.

Dual-Speed Mode Commands

Table 4-5a: Dual-Speed Commands

Header	*Function*
DS	Set dual speeds
DX	Define whether the timer or a trigger will cause the change from one speed to another
DD	Set the duration of time if timer is selected
DM	Select format for dual-speed output
DB	Start dual-speed operation

Table 4-5b: Dual-Speed Queries

Header	*Function*
DS?	What are the two speed settings?
DX?	Will the timer or a trigger cause the change from one speed to another?
DD?	What is the time duration if timer is selected?
DM?	What is the format for dual-speed output?
DB?	Is dual-speed operation in process?

✦ *Set Dual Speeds*

The *Set Dual Speeds Command* determines the two speeds of recorder output between which the DASH 8 will toggle while under dual-speed operation.

Command:	[DS] [n],[x],[y] [*]
Parameters:	n = 1 or 2 to represent the speed number
	x = 1 to 200* to represent speed in millimeters per unit of time
	y = 1 for millimeters per second
	y = 2 for millimeters per minute
	y = 3 for millimeters per hour
Example:	DS 2,50,2 <lf>
	sets speed #2 for 50 millimeters per minute.

* The MOD2 version of the DASH 8 Recorder has a maximum speed of 100 millimeters per second.

The *Dual Speeds Query* requests the two speeds of recorder output between which the DASH 8 will toggle while under dual-speed operation.

Query:	[DS?] [n] [*]
Parameters:	n = 1 or 2 to represent the speed number
Valid Responses:	n,x,y
	where:
	n = 1 or 2 for the speed number
	x = 1 to 200 to represent speed
	y = 1, 2, or 3 for unit of time
Example:	DS? 2 <lf>
Sample Response:	2,50,2
	indicates that speed #2 is set for 50 millimeters per minute.

✦ ***DUAL-SPEED SWITCH*** The *Dual-Speed Switch Command* defines whether the timer or a trigger will cause the change from one speed to the other.

Command:	[DX] [n],[x] [*]
Parameters:	n = 1 for speed #1 n = 2 for speed #2 x = 0 for timer x = 1 for trigger
Example:	DX 1,0 <lf> specifies that recording will switch to speed #1 at the expiration of the time duration specified by the Dual-Speed Duration Command.

The *Dual-Speed Switch Query* defines whether the timer or a trigger will cause the change from one speed to the other.

Query:	[DX?] [n] [*]
Parameters:	n = 1 or 2 for speed number
Valid Responses:	n,x where: x = 0 for timer x = 1 for trigger
Example:	DX? 1 <lf>
Sample Response:	1,0 specifies that recording will switch to speed #1 at the expiration of the time duration specified by the Dual-Speed Duration Command.

✦ ***DUAL-SPEED DURATION*** The *Dual-Speed Duration Command* defines the durations of each speed if timer is selected.

Command:	[DD] [n],[s] [*]
Parameters:	n = 1 for speed #1 n = 2 for speed #2 s = time string in "hh:mm:ss" format to represent the duration of time

Example: DD 1,"01:15:45" <lf>
sets the duration of time for operation at speed #1 to one hour, 15 minutes, and 45 seconds.

The *Dual-Speed Duration Query* requests the time duration of a speed if timer is selected.

Query: [DD?] [n] [*]
Parameters: n = 1 or 2 for speed number
Valid Responses: n,s
where:
s = time string in "hh:mm:ss" format to represent the duration of time
Example: DD? 1 <lf>
Sample Response: 1,"01:15:45" <lf>
indicates that the duration of time for operation at speed #1 is one hour, 15 minutes, and 45 seconds.

✦ ***DUAL-SPEED FORMAT*** The *Dual-Speed Format Command* specifies the format for recorder output during dual-speed operation.

Command: [DM] [x] [*]
Parameters: x = 1 for a one-grid format
8 signals, all overlapped
x = 2 for a two-grid format
8 signals, 4 overlapped on each grid
x = 4 for a four-grid format
8 signals, 2 overlapped on each grid
x = 6 for a six-grid format
6 signals, 1 for each grid
x = 8 for an eight-grid format
8 signals, 1 for each grid
x = U for user format, based upon user chart setup parameters
Example: DM 6 <lf>
specifies six-grid format during dual-speed operation.

The *Dual-Speed Format Query* requests the format used for recorder output during dual-speed operation.

Query:	[DM?] [*]
Parameters:	none
Valid Responses:	x = 1 for a one-grid format x = 2 for a two-grid format x = 4 for a four-grid format x = 6 for a six-grid format x = 8 for an eight-grid format x = U for user format x = D for Data Logger format
Example:	DM? <lf>
Sample Response:	6 <lf> indicates six-grid format during dual-speed operation.

✦ ***START DUAL-SPEED OPERATION***

The *Start Dual-Speed Operation Command* starts dual-speed operation of the DASH 8 Recorder in the format specified via the DM Command.

Command:	[DB] [*]
Parameters:	none
Example:	DB <lf> starts dual-speed operation.

The *Start Dual-Speed Operation Query* requests the status of dual-speed operation for the DASH 8.

Query:	[DB?] [*]
Parameters:	none
Valid Responses:	0 = dual-speed operation not active 1 = dual speed #1 is active 2 = dual speed #2 is active
Example:	DB? <lf>
Sample Response:	1 <lf> indicates that the DASH 8 is operating at speed number 1.

4-2 Data Capture and Playback Modes

Data Capture Mode (DC-85 option required)

The Data Capture Mode causes the DASH 8 to perform a data capture sequence wherein analog data is digitized and stored in memory. A data capture occurs when previously specified triggering conditions are met or when the Data Capture Mode Command is sent.

The data capture is performed according to current acquisition settings, including sample rate, storage method, and window size. These settings are determined during system setup and are described in Chapter 3. For additional information on the Data Capture Mode, refer to the *DASH 8 Operations Manual.*

The data capture is completed when the window is filled to the specified size and the trigger condition has been met.

The *Data Capture Mode Command* enters the DASH 8 into Data Capure Mode by performing a data capture sequence according to current acquisition system settings.

Command:	[AC] [r] [*]
Parameters:	r = 1 to 8 for record number, if data capture is set up to be segmented (Omit this parameter if data capture is set up as normal, via the Acquisition Type Command described in Chapter 3.)
Example:	AC <lf> causes the DASH 8 to perform a normal data capture sequence.

The *Data Capture Mode Query* requests whether a data capture is in progress.

Query:	[AC?] [*]
Parameters:	none
Valid Responses:	r,t where: r = 1 to 8 for record number or N for normal t = 0 for pre-trigger t = 1 for post-trigger
Example:	AC? <lf>
Sample Response:	N,1 <lf> indicates that the DASH 8 is acquiring post-trigger normal data.

Data Capture Command

Table 4-6: Data Capture Command

Header	*Function*
EX	Exit (abort) acquisition and return to Idle Mode

✦ ***Exit***

The *Exit Command* allows the host to abort a data acquisition sequence that was started with the Data Capture Mode Command.

Command:	[EX] [*]
Parameters:	none

DATA PLAYBACK MODE (DC-85 OPTION REQUIRED)

Data Playback Mode allows you to print stored data. The data is stored in digitized form but can be played out on the chart in a variety of formats.

Note: Certain commands sent while a playback is in progress will cause the playback to abort. Therefore, system setup should be done before a playback to avoid interruption.

The *Data Playback Mode Command* causes the DASH 8 to begin data playback in the format specified:

Command: [PM] [m],[r] [*]

Parameters:
- m = 1 for a one-grid format, 8 signals, all overlapped
- m = 2 for a two-grid format, 8 signals, 4 overlapped on each grid
- m = 4 for a four-grid format, 8 signals, 2 overlapped on each grid
- m = 6 for a six-grid format, 6 signals, 1 for each grid
- m = 8 for an eight-grid format, 8 signals, 1 for each grid
- m = U for user format, based upon user chart setup parameters
- m = N for numeric playback
- m = L for X/Y plot format
- r = 1 to 8 for record number, if data capture is set up to be segmented (Omit this parameter if data capture is set up as normal, via the Acquisition Type Command described in Chapter 3.)

Example: PM 8 <lf>
specifies that data is to be played back in eight-channel format.

Output does not begin until the Start or Run Command is sent. To determine when playback is completed, you can send the Status Request Query (QS). For additional information on the Data Playback Mode, refer to the *DASH 8 Operations Manual.*

The *Data Playback Mode Query* requests whether the DASH 8 is playing back data and, if so, in what format:

Query:	{PM?} [*]
Parameters:	none
Valid Responses:	m,r where: m = 1 for a one-grid format m = 2 for a two-grid format m = 4 for a four-grid format m = 6 for a six-grid format m = 8 for an eight-grid format m = U for user format m = N for numeric playback m = L for X/Y plot format r = 1 to 8 for record number or N for normal
Example:	PM 8,N <lf> specifies that normal acquisition data is to be played back in eight-channel format.

Note: If the Data Playback Query is sent while the DASH 8 is not in Data Playback Mode, a 0 is returned to indicate Idle Mode.

	Table 4-7a: Data Playback Mode Commands
Header	*Function*
ST	Start or stop the recorder output (toggle)
RU	Start recorder output
HA	Halt recorder output
ID	Label the signals with numeric identification
PC	Control printing of interchannel text buffers
PO	Print content of on-demand buffer
EX	Exit Data Playback Mode to Idle Mode

	Table 4-7b: Data Playback Queries
Header	*Function*
ST?	Is the recorder currently running?
RU?	Is the recorder currently running?
HA?	Is the recorder currently running?
PC?	Are interchannel text buffers printing, and, if so, one time or repeatedly?
PO?	Is the On-Demand Buffer currently printing?

Data Playback Commands and Queries

✦ ***Start/Stop*** The *Start/Stop Toggle Command* starts or stops the motor, thus controlling recorder chart output. This is a toggle command, meaning that the same command changes the recorder state from the one it is currently in to the other. That is, if the recorder is running, ST will stop it; if it is not running, ST will start it. (There are also separate RUN/HALT commands available.)

When a Start Command is sent, the recorder plays back as much data as has been stored by a previous data capture.

Command:	[ST] [*]
Parameters:	none
Example:	ST <lf>

The *Start/Stop Query* requests motor status, that is, whether or not the motor and chart are running.

Query:	[ST?] [*]
Parameters:	none
Valid Responses:	0 for motor is stopped 1 for motor is running
Example:	ST? <lf>
Sample Response:	1 <lf> indicates that the motor is running.

✦ ***RUN AND HALT***

The *Run and Halt Commands* control the running of the recorder while in the Data Playback Mode. This command is similar to the Start/Stop Toggle Command.

When the Run Command is sent, the recorder plays back as much data as has been stored by a previous data capture.

Command:	[RU] [*] or [HA] [*]
Parameters:	none
Example:	RU <lf> starts data playback.

The *Run and Halt Queries* also request motor status, that is, whether or not the motor and chart are running. These three queries all request the same information and receive the same valid responses.

Query:	[RU?] [*] or [HA?] [*]
Parameters:	none
Valid Responses:	0 for motor is stopped 1 for motor is running
Example:	RU? <lf>
Sample Response:	1 <lf> indicates that the motor is running.

✦ ***Identification***

The *Identification (ID) Command* causes a numeric ID to be printed on each signal to clearly identify which trace represents which input signal. This is very useful during overlap recording.

Command:	[ID] [*]
Parameters:	none
Example:	ID <lf>

Note: Issuing this command is comparable to pressing the front-panel ID Key. To print the numeric ID repeatedly, use the Automatic Identification Command (AI), which is described under system setup.

✦ ***Print Interchannel Text Buffer***

The *Print Interchannel Text Buffer Command* controls whether and how the interchannel text buffers are printed in the analog record.

Command:	[PC] [x] [*]
Parameters:	x = 0 turns printing off
	x = 1 causes text buffers to be printed once
	x = 2 causes printing to be repeated
Example:	PC 1 <lf>
	causes text buffers to be printed once.

The *Interchannel Text Print Query* requests whether and how interchannel annotation is printing.

Query:	[PC?] [*]
Parameters:	none
Valid Responses:	0 for printing off
	1 for printing one time
	2 for printing repeatedly
Example:	PC? <lf>
Sample Response:	1 <lf>
	indicates that interchannel annotation is printing one time.

✦ ***PRINT ON-DEMAND BUFFER***

The *Print On-Demand Buffer Command* causes the content of the on-demand buffer to be printed immediately.

Command:	[PO] [*]
Parameters:	none
Example:	PO <lf> causes the contents of the on-demand buffer to be printed immediately one time.

The *Print On-Demand Buffer Query* requests whether the on-demand buffer has finished printing.

Query:	[PO?] [*]
Parameters:	none
Valid Responses:	0 for buffer finished printing 1 for buffer in process of printing
Example:	PO? <lf>
Sample Response:	0 indicates that the on-demand buffer has finished printing.

✦ ***EXIT DATA PLAYBACK MODE***

The *Exit Data Playback Mode Command* ends data playback and returns the recorder to Idle Mode, where it awaits a new mode command header.

Command:	[EX] [*]
Parameters:	none
Example:	EX <lf>

4-3 DATA TRANSFER MODE (DC-85 OPTION REQUIRED)

The DASH 8 Recorder has the ability to transfer acquired data from its RAM card to the host computer, where it can be archived or used for data analysis. To perform an upload, the DASH 8 must be configured with the DC-85 data capture option. The DASH 8 uses it circular output buffer to transfer data; the output buffer is flushed at the start of an upload.

When the Data Upload Command is sent from the host computer, the entire contents of the last acquisition is uploaded for the requested channel. When issuing the Upload Command, you specify the channel number, and the segment number if the acquisition type is segmented.

The DASH 8 responds with a 31-character header followed by 32,768 kilosamples of data if the acquisition type is normal or 4,096 kilosamples of data if the acquisition type is segmented. A checksum character is appended and terminated with an EOI only on the last byte.

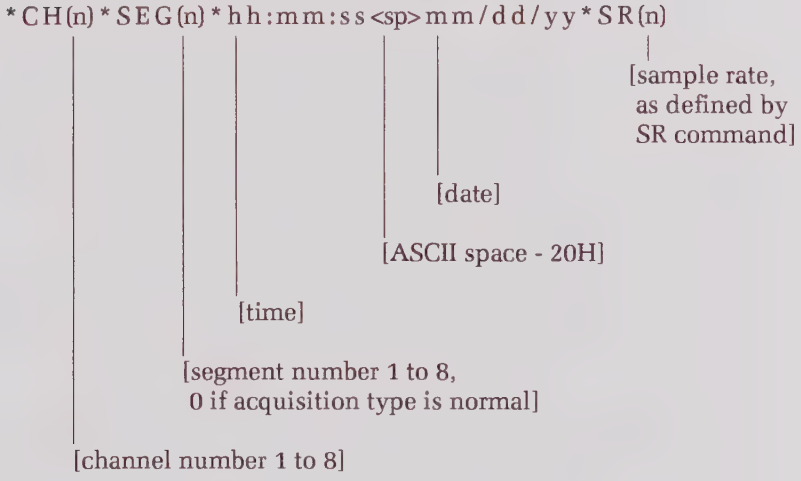
To upload data from the DASH 8 to the host computer, send the *Data Upload Command*:

Command:	[UP] [n],[s] [*]
Parameters:	n = 1 to 8 for channel number s = 1 to 8 for segment number (This parameter is ignored if acquisition type is set up as normal, via the Acquisition Type Command described in Chapter 3.)
Example:	UP 3 <lf> uploads data from channel 3 from the DASH 8 to the host computer.

If the host requests an invalid channel, the DASH 8 will upload data from channel 1 (and segment 1 if the acquisition type is segmented).

If the command is issued correctly, the DASH 8 responds with data from the specified channel (and segment), preceded by the 31-character header that provides the channel number, segment number if applicable, time/date, and sample rate of the acquisition.

The header is sent in the following format:


*CH(n)*SEG(n)*hh:mm:ss<sp>mm/dd/yy*SR(n)
[sample rate, as defined by SR command]
[date]
[ASCII space - 20H]
[time]
[segment number 1 to 8, 0 if acquisition type is normal]
[channel number 1 to 8]

The captured data immediately follows the header, uploaded in low-byte/high-byte format and terminated with an EOI:

<lsb>	(lsb of sample 1)
<msb>	(msb of sample 1)
<lsb>	(lsb of sample 2)
<msb>	(msb of sample 2)
.	
.	
.	
<lsb>	(lsb of sample 4,096 or 32,768)
<msb>	(msb of sample 4,096 or 32,768)
<lsb>	(lsb of checksum)
<msb> + EOI	(msb of checksum with attached EOI)

The binary digitized data has a range of 000H to FFFH (hexadecimal) or 0000 to 4,095 (decimal). This range includes the full width of the channel, including the over-range built into each channel. The actual top of the grid corresponds to approximately E66H or 3,686; the bottom with 19AH or 410.

The checksum is a simple 16-bit sum of the digitized data sent to the host, used to check the integrity of the transfer.

Note: During a data upload, the DASH 8 input buffer is active, allowing the host to send system setup commands. The Exit Command (EX) can be used to abort an upload. Mode entry commands will also cause an upload to abort, and will enter the DASH 8 into a new mode of operation.

Query commands cannot be executed, since they use the output buffer to generate a response message.

Commands that may affect the upload in progress will not be executed and an execution error will be generated.

4-4 LINE PRINTER MODE

The DASH 8 Recorder can also operate as a normal printer. To enter *Line Printer Mode* and specify the format, enter the following command:

Command:	[LP] [n],[m] [*]
Parameters:	n = 1 for normal printing
	n = 2 for inverted printing (180°)
	n = 3 for rotated printing (90°), page printer (96 rows by 132 columns)
	m = 80 for an 80-column line printer (n = 1 or 2)
	m = 96 for a 96-column line printer (n = 1 or 2) (m is ignored if n = 3)
Example:	LP 1,96 <lf> causes the DASH 8 to function as a standard 96-column line printer.

Note: While page printing (n=3), the DASH 8 prints a maximum of 96 rows by 132 columns. If the longest line on the page is less than 132 columns, the DASH 8 only prints the number of columns of the longest line sent.

All data characters transferred are processed normally by the DASH 8. Control characters that may normally be used for command termination are interpreted as follows:

09H	*Horizontal tab* tabs in 8-space increments.
0AH	*Line feed* advances the pointer to a new line.
0CH	*Form feed* advances the pointer to the top of form during line printing (n = 1 or 2). *Form feed* prints a page and advances the pointer to a new page during page printing (n = 3).
0DH	*Carriage return* advances the pointer to the beginning of the same line.
03H	*Control C* exits Line Printer Mode to Idle Mode.

In Line Printer Mode, the DASH 8 accepts an unlimited number of characters into a buffer until receiving a <lf> (line feed). Upon a <lf> the printer prints the buffer contents immediately, up to 80 or 96 characters. Upon receiving a <cr> (carriage return), the recorder returns to the beginning of the same line and begins over-writing the buffer. The only method for exiting printer operation to return to Idle Mode is sending 03H (ASCII Control-C).

Figure 4-1 illustrates the normal 96-column line printer. Figure 4-2 illustrates the inverted 96-column line printer (180°). Figure 4-3 illustrates the rotated page printer (90°).

Note: These figures are reduced for printing and thus are not true to the actual scale of DASH 8 output.

DASH 8 DEMONSTRATION/TEST SOFTWARE

Program: DASH8.BAS

SYSTEM CONFIGURATION:

IBM-PC, AT, PS/2 or compatible with a minimum of 256k RAM, DOS 2.0 or higher, an IBM or National Instruments GPIB (IEEE-488) adapter. Additionally, interpreter basic (BASICA.COM or GWBASIC.EXE) is required to run the program. A CGA compatible monitor and display adapter are required to run the PLOT.EXE program to display data uploaded from the recorder.

GPIB (IEEE-488) INTERFACE SET-UP:

1. Follow the instructions in your IBM Manual entitled: "Guide to the General Purpose Interface Bus Adapter". Please refer to chapter 1: "Programming Support for Creating a Working Environment".

* Run the installation program GPIBSET.BAT

* Use the following format GPIBSET A:488 BASICA

2. In the same manual, please refer to chapter 3: "Configuring your GPIB System". Please follow the instructions in this chapter.

(The above two steps will create two files:CONFIG.SYS and GPIB.COM. Both files must be on the disk that the system is booted up on in order for the correct GPIB (IEEE-488) configuration to take place).

3. Boot up (or reboot) the system using the files created in steps 1 and 2.

4. Set the GPIB communications on the recorder to GPIB address 05 and termination to EOI only. This is accomplished by using the front panel keys to access the [SYSTEM] [I/O] and [GPIB SET] menus. These settings are stored in non-volatile memory and only have to be stored once.

5. Run Basic Interpreter.

6. Load DASH8.BAS

7. Run

8. In the event of an error or lock-up, carefully compare the GPIB initialization lines in DASH8.BAS to the lines in the file DECL.BAS which was supplied with the GPIB adapter. These lines should match EXACTLY for this program to work with your GPIB device driver version and interface card. Also check the line at the top of DASH8.BAS that reads CLEAR ,58892! for the correct value for your system as determined by the method described in your GPIB interface manual for interpreter basic.

DIRECTION OF PAPER TRAVEL

Figure 4-1: 96-Column Line Printer

GPIB interface manual for interpreter basic.
correct value for your system as determined by the method described in your
check the line at the top of DASH8.BAS that reads CLEAR ,58892! for the
program to work with your GPIB device driver version and interface card. Also
was supplied with the GPIB adapter. These lines should match EXACTLY for this
initialization lines in DASH8.BAS to the lines in the file DECL.BAS which
8. In the event of an error or lock-up, carefully compare the GPIB

7. Run

6. Load DASH8.BAS

5. Run Basic Interpreter.

stored in non-volatile memory and only have to be stored once.
keys to access the [SYSTEM] [I/O] and [GPIB SET] menus. These settings are
termination to EOI only. This is accomplished by using the front panel
4. Set the GPIB communications on the recorder to GPIB address 05 and

3. Boot up (or reboot) the system using the files created in steps 1 and 2.

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* Run the installation program GPIBSET.BAT

Support for Creating a Working Environment".
Purpose Interface Bus Adapter". Please refer to chapter 1: "Programming
1. Follow the instructions in your IBM Manual entitled: "Guide to the General

GPIB (IEEE-488) INTERFACE SET-UP:

recorder.
required to run the PLOT.EXE program to display data uploaded from the
to run the program. A CGA compatible monitor and display adapter are
Additionally, interpreter basic (BASICA.COM or GWBASIC.EXE) is required
an IBM or National Instruments GPIB (IEEE-488) adapter.
IBM-PC, AT, PS/2 or compatible with a minimum of 256k RAM, DOS 2.0 or higher,

SYSTEM CONFIGURATION:

Program: DASH8.BAS

DASH 8 DEMONSTRATION/TEST SOFTWARE

DIRECTION OF PAPER TRAVEL

Figure 4-2: 96-Column Inverted Line Printer (180° rotation)

DIRECTION OF PAPER TRAVEL

Figure 4-3: Page Printer

A COMMAND HEADERS

DASH 8 MODE ENTRY COMMANDS

Real-Time Recording Modes:	RT	Analog Real-Time
	DL	Data Logger
	TB	Timed Operation
	DB	Dual-Speed Operation
Data Capture and Playback Modes:	AC	Acquire (Data Capture)
	PM	Data Playback
Data Transfer Mode:	UP	Data Upload
Line Printer Mode:	LP	Line Printer
Additional Commands:	FF	Form Feed
	HS	Help Sheet
	PV	Paper Advance

Complete System Setup Commands

Header	*Function*
DF	Establish default settings as system setup
ME	Memorize all current settings and store
RE	Establish stored setup as system setup

Timing Setup Commands

Header	*Function*
TI	Set time
DA	Set date
MC	Define source of motor clock
TM	Set time mark interval

Timing Setup Queries

Header	*Function*
TI?	What is the current time?
DA?	What is the current date?
MC?	Is the motor clock source internal or external?
TM?	What is the time interval between the printing of time marks?

Chart and Grid Setup Commands

Header	*Function*
GR	Enable/disable printing of major chart grids
GM	Enable/disable printing of minor grid divisions
GS	Synchronize horizontal grid lines to time interval
SE	Enable/disable printing of system event marker
SL	Enable/disable printing of system log channel
ES	Edit content of system log channel
EO	Edit content of on-demand buffer
AI	Enable/disable printing of signal identification
AE	Specify whether alphanumeric data, an event marker, or nothing will print in an interchannel buffer
PC	Control printing of an interchannel text buffer
ED	Edit content of an interchannel text buffer
PL	Enable/disable printing for an analog channel

Chart and Grid Setup Queries

Header	*Function*
GR?	Is printing of major chart grids enabled?
GM?	Is printing of minor grid divisions enabled?
GS?	Are horizontal grid lines synchronized to time interval?
SE?	Is printing of system event marker enabled?
SL?	Is printing of system log channel enabled?
ES?	What is the content of the system log channel?
EO?	What is the content of the on-demand buffer?
AI?	Is printing of signal identification enabled?
AE?	Is an interchannel buffer set to print alphanumeric data, an event marker, or nothing?
PC?	Will an interchannel text buffer print once, repeatedly, or not at all?
ED?	What is the content of an interchannel text buffer?
PL?	Is printing enabled for an analog channel?

User Chart Setup Commands

Header	*Function*
UT	Define position of an interchannel text buffer
UE	Define position of an event marker
UG	Enable/disable printing of major and minor grids
US	Define the size of a waveform
UC	Define position of a channel and waveform

User Chart Setup Queries

Header	*Function*
UT?	What is the position of an interchannel text buffer?
UE?	What is the position of an event marker?
UG?	Is printing of major and minor grids enabled?
US?	What is the size of a waveform?
UC?	What is the position of a channel and waveform?

Analog Setup Commands

Header	*Function*
GD	Specify signal in or ground for an analog channel
CA	Calibrate all analog channels
NC	Define numeric calibration
AS	Enable/disable auto-range for a channel
AT	Set auto-range sampling time
AR	Perform auto-ranging
RS	Set full-scale volt range
ZE	Position zero volts (ground) on chart
ZS	Set units of zero suppression
MS	Specify whether input is peak to peak or RMS
FS	Enable/disable 10Hz low-pass filter for a channel
CR	Enable/disable signal conditioner reporting

Analog Setup Queries

Header	*Function*
GD?	Is the signal in or grounded for an analog channel?
CA?	Calibrate all analog channels and return status
NC?	How is numeric calibration defined?
AS?	Is auto-range enabled for a channel?
AT?	What is the auto-range sampling time?
RS?	What is the full-scale volt range?
ZE?	Where is zero volts (ground) positioned on the chart?
ZS?	How many units of zero suppression are set?
MS?	Is input peak-to-peak or RMS?
FS?	Is the 10Hz low-pass filter enabled for a channel?
CR?	Is signal conditioner reporting enabled?

Acquire Setup Commands

Header	*Function*
SR	Set the sample rate for data capture
TW	Specify the trigger/window relationship for data capture
AM	Specify how data is to be stored: normal (32Ksamples per channel) or segmented (eight 4-Ksample records per channel)

Acquire Setup Queries

Header	*Function*
SR?	What is the sample rate for data capture?
TW?	What is the trigger/window relationship for data capture?
AM?	How is data to be stored: normal or segmented?

Trigger Setup Commands

Header	*Function*
TS	Define trigger source
TA	Associate channels in an "and" relationship
TO	Associate channels or groups of channels in an "or" relationship
TL	Define trigger level and slope
TE	Establish a trigger to occur at periodic intervals

Trigger Setup Queries

Header	*Function*
TS?	What are the trigger source(s)?
TA?	Which channels are associated in an "and" relationship in a particular group?
TO?	Which groups are associated in an "or" relationship?
TL?	What is the level and slope for an analog trigger?
TE?	At what time intervals will a timed trigger occur?

Playback Setup Commands

Header	*Function*
XY	Select x and y channels
MG	Specify reduction or magnification of playback
PP	Specify percentage of playback

Playback Setup Queries

Header	*Function*
XY?	Which channels are selected as x and y channels for x/y plotting of two captured signals?
MG?	What is the reduction or magnification of playback?
PP?	What is the percentage of data to be played back?

Analog Real-Time Recorder Commands

Header	*Function*
ST	Start or stop the recorder output (toggle)
RU	Start recorder output
HA	Halt recorder output
SP	Change and set motor speed
ID	Label the waveforms with numeric identification
PC	Control printing of interchannel text buffers
PO	Print content of on-demand buffer
BC	Arm/disarm background data capture
EX	Exit Analog Real-time Recorder Mode to Idle Mode

Analog Real-Time Recorder Queries

Header	*Function*
ST?	Is the recorder currently running?
RU?	Is the recorder currently running?
HA?	Is the recorder currently running?
SP?	What is the current motor speed?
PC?	Are interchannel text buffers printing, and, if so, once or repeatedly?
PO?	Are the contents of the On-Demand Buffer currently printing?
BC?	Is background data capture armed or disarmed?

Data Logger Commands

Header	*Function*
ST	Start or stop the recorder output (toggle)
RU	Start recorder output
HA	Halt recorder output
BC	Arm/disarm background data capture
EX	Exit Data Logger Mode to Idle Mode

Data Logger Queries

Header	*Function*
ST?	Is the recorder currently running?
RU?	Is the recorder currently running?
HA?	Is the recorder currently running?
BC?	Is background data capture armed or disarmed?

Timed Operation Commands

Header	*Function*
TT	Set start time
TP	Set stop time
TD	Set timer speed
TF	Select format for timed output
TB	Start timed operation

Timed Operation Queries

Header	*Function*
TT?	What is the start time for timed operation?
TP?	What is the stop time for timed operation?
TD?	What is the speed during timed operation?
TF?	What is the format for timed output?
TB?	Is timed operation in process?

Dual-Speed Commands

Header	*Function*
DS	Set dual speeds
DX	Define whether the timer or a trigger will cause the change from one speed to another
DD	Set the duration of time if timer is selected
DM	Select format for dual-speed output
DB	Start dual-speed operation

Dual-Speed Queries

Header	*Function*
DS?	What are the two speed settings?
DX?	Will the timer or a trigger cause the change from one speed to another?
DD?	What is the time duration if timer is selected?
DM?	What is the format for dual-speed output?
DB?	Is dual-speed operation in process?

Data Capture Command

Header	*Function*
EX	Exit (abort) acquisition and return to Idle Mode

Data Playback Mode Commands

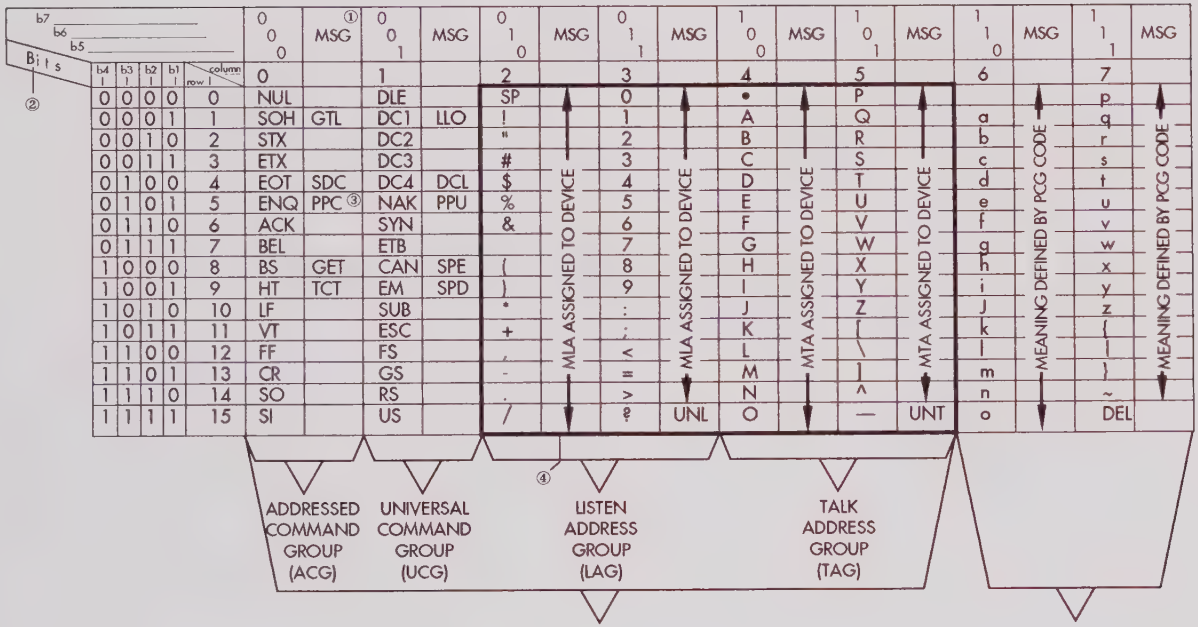
Header	*Function*
ST	Start or stop the recorder output (toggle)
RU	Start recorder output
HA	Halt recorder output
ID	Label the signals with numeric identification
PC	Control printing of interchannel text buffers
PO	Print content of on-demand buffer
EX	Exit Data Playback Mode to Idle Mode

Data Playback Queries

Header	*Function*
ST?	Is the recorder currently running?
RU?	Is the recorder currently running?
HA?	Is the recorder currently running?
PC?	Are interchannel text buffers printing, and, if so, once or repeatedly?
PO?	Is the On-Demand Buffer currently printing?

B Multiline Interface Messages

(SENT AND RECEIVED WITH ATN=1)


b7
b6
b5
Bits
b4 b3 b2 b1
column
row
MSG
NUL SOH STX ETX EOT ENQ ACK BEL BS HT LF VT FF CR SO SI
DLE DC1 DC2 DC3 DC4 NAK SYN ETB CAN EM SUB ESC FS GS RS US
GTL LLO SDC DCL PPC PPU GET SPE TCT SPD
SP ! " # $ % & ( ) * + , - . /
0 1 2 3 4 5 6 7 8 9 : ; < = > ?
A B C D E F G H I J K L M N O
P Q R S T U V W X Y Z [\ ] ^ —
a b c d e f g h i j k l m n o
p q r s t u v w x y z { | } ~ DEL
MLA ASSIGNED TO DEVICE
MTA ASSIGNED TO DEVICE
MEANING DEFINED BY PCG CODE
UNL
UNT
ADDRESSED COMMAND GROUP (ACG)
UNIVERSAL COMMAND GROUP (UCG)
LISTEN ADDRESS GROUP (LAG)
TALK ADDRESS GROUP (TAG)
PRIMARY COMMAND GROUP (PCG)
SECONDARY COMMAND GROUP (SCG)

Notes: ① MSG = Interface Message
② b_1 = DI01... b_7 = DI07
③ Requires secondary command
④ Dense subset (columns 2 through 5)

INDEX

A

Acquire Setup 3-39 — 3-41
acquired data 3-39 — 3-41, 4-25 — 4-32, 4-7, 4-13
acquisition 3-39 — 3-41, 4-25 — 4-32, 4-7, 4-13
acquisition settings 3-39 — 3-41
acquisition type 3-41
active system setup 1-3, 3-4, 3-5
alphanumeric annotation 3-19
amplitude, signal 3-34
analog controls 3-28 — 3-38
Analog Real-Time Recorder Commands 4-4 — 4-9
Analog Real-Time Recorder Mode 4-2 — 4-9
analog real-time recording 4-2 — 4-9
Analog Setup 3-28 — 3-38
analog trigger 3-43 — 3-47
"And" channel groups 3-44
annotation, interchannel 3-19, 3-23, 4-6, 4-31
automatic calibration 3-28
automatic identification 3-18
auto-range 3-31 — 3-33

B

background data capture 4-7, 4-13
baseline offset 3-36
buffer, print 3-37
buffers, input/output 2-9
buffers, interchannel 3-19, 3-23, 4-6, 4-31

C

calibration 3-28 — 3-30
captured data 3-39 — 3-41, 4-25 — 4-32, 4-7, 4-13
Chart and Grid Setup 3-11 — 3-27
chart divisions 3-13, 3-24
chart formats 4-2, 4-18, 4-23, 4-27
chart speeds 4-5, 4-10
command format 1-4 — 1-6
command header 1-4
command structure 1-4 — 1-6
communications interface 2-1 — 2-9
communications menu 2-3, 2-4
completion status 2-8, 2-9, 3-33, 4-8, 4-14, 4-27
current system setup 1-3, 3-4, 3-5

D

data acquisition 3-39 — 3-41, 4-25 — 4-32, 4-7, 4-13
data capture 3-39 — 3-41, 4-25 — 4-32, 4-7, 4-13
data capture memory 4-25
Data Capture Mode 4-25, 4-26
data capture sample rates 3-39
Data Logger Mode 4-11 — 4-14
data playback 3-48 — 3-50, 4-27 — 4-32
Data Playback Mode 4-27 — 4-32
data transfer 4-33 — 4-35
Data Transfer Mode 4-33 — 4-35
date and time 3-8, 3-9
DC-85 Option 3-39 — 3-41, 4-25 — 4-32, 4-7, 4-13

default setup 3-4 — 3-7
digital data 3-30, 4-11 — 4-14, 4-27, 4-33 — 4-35
Dual-Speed Operation 4-20 — 4-24
dual-speed format 4-23
dual-speed duration 4-22
dual speeds 4-21

E

editing, interchannel text buffer 3-19
editing, on-demand buffer 3-17
editing, system log channel 3-16
enable remote (host) control 2-4
EOI (end or identify) 2-4, 2-5, 4-33, 4-34
errors 2-7, 2-8
event marker, system 3-15
event markers, interchannel 3-19, 3-23
exiting modes 4-9, 4-14, 4-26, 4-32
exit remote (host) control 2-4
external clock 3-9

F

filter, low-pass 3-37
form feed 3-2
formats, chart 4-2, 4-18, 4-23, 4-27
formats, line printer 4-36 — 4-40
full-scale input 3-31, 3-34, 3-35, 3-37
full-scale voltage 3-31, 3-34, 3-37

G

GPIB address 2-3
GPIB capabilities 2-5
GPIB communications 2-1 to 2-6
GPIB interface commands 2-6
GPIB pin connections 2-2
Grid Setup 3-11 — 3-27
grids 3-13, 3-24, 4-2, 4-18, 4-23, 4-27
ground 3-28

H

help sheet 3-2
help sheet language 3-3

I

identification, automatic 3-18
identification, signal 4-6, 4-31
Idle Mode 1-3, 4-9, 4-14, 4-32
IEEE-488 connector 2-1 — 2-6
initial setup 3-1 — 3-4
input mode 3-37
input signal 3-31, 3-34, 3-35, 3-37
interchannel annotation 3-19, 3-23, 4-6, 4-31
interchannel event marker 3-19, 3-23
interchannel text buffer 3-19, 3-23, 4-6, 4-31
internal clock 3-9

L

line printer 4-36 — 4-40
Line Printer Mode 4-36 — 4-40
local control 2-4
logging speed 4-10, 4-17
low-pass filter 3-37

M

magnification of data 3-49
major chart grid 3-13, 3-24
memorize or recall setup 3-4
memory 2-9, 4-25, 4-33, 4-37
minor grid divisions 3-13
mode, analog 3-37
mode entry commands 4-1, A-1
modes of operation 1-3, 1-4, 4-1 — 4-40
motor clock source 3-9
motor speed 3-9, 4-5
multiline interface messages 2-6, B-2

N

numeric calibration 3-30
numeric data 3-30, 4-11 — 4-14, 4-27, 4-33 — 4-35
numeric format 3-30, 4-10 — 4-14
numeric identification 4-6, 4-31

O

on-demand buffer 3-17, 4-7, 4-32
overlapped recording 4-2, 4-18, 4-23, 4-27
"Or" channel groups 3-45

P

page printer 4-36, 4-40
paper advance 3-2
pen lift 3-20
pin connections 2-2
playback 3-48 — 3-50, 4-27 — 4-32
playback percentage 3-50
Playback Setup 3-48 — 3-50
print rate 3-9
printing, line printer 4-36 — 4-40
printing modes 4-36 — 4-40
printing, rotated 4-36, 4-40

Q

Queries 1-6

R

range 3-34
Real-Time Recording Modes 4-1 — 4-24
rear panel, DASH 8 2-1
recall setup 3-4
reporting, signal conditioner 3-38
rotated printing 4-36, 4-40

S

sample period 3-31, 3-32
sample rates 3-40
sample signals 3-31
sensitivity, signal 3-34
serial poll 2-7, 2-8
service request 2-7, 2-8
signal amplitude 4-2

signal conditioner 3-38
signal identification 4-6, 4-31
signal sensitivity 3-34
signal size 3-25
speed, motor 3-9, 4-5
SRQ 2-7, 2-8
status byte 2-7, 2-8
status information 2-7, 2-8, 3-32, 4-8, 4-14, 4-27
status request 2-9, 3-33, 4-8, 4-14, 4-27
stored data 3-39 — 3-41, 4-25 — 4-32, 4-7, 4-13
stored system setup 3-4
synchronization, grid 3-14
system default 3-4, 3-6, 3-7
system default setup 3-4
system event marker 3-15
system log channel 3-16
System Setup Commands 3-1 — 3-51

T

terminator 1-5, 1-7, 2-4, 2-5, 4-33, 4-34
text buffers 3-19, 3-23, 4-6, 4-31
time and date 3-8, 3-9
time mark interval 3-10
time marks 3-10
Timed Operation 4-15 — 4-19
Timing Setup 3-8 — 3-10
trigger 3-42 — 3-47, 4-20, 4-22, 4-25
trigger channels, active 3-42 — 3-47
trigger level/slope 3-46
Trigger Setup 3-42 — 3-47
trigger source 3-43
trigger/window relation 3-40
troubleshooting 2-7 — 2-9

U

upload 4-33 — 4-35
User Chart Setup 3-21 — 3-27

W

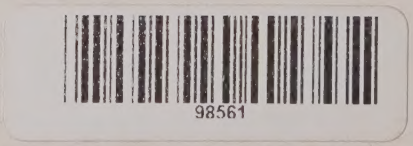
window size 3-40

X

X and Y channels 3-49
x/y plots 3-49

Z

zero position 3-35
zero suppression 3-36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